HUMAN GEOGRAPHY

PUBLISHER'S NOTE

This translation has been prepared from the 1947 French edition with the active assistance throughout of Mme M. Jean-Brunhes Delamarre.

HUMAN GEOGRAPHY

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ABRIDGED EDITION

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RAND McNALLY & COMPANY
NEW YORK CHICAGO SAN FRANCISCO

Dewey Decimal classification: 910

MADE IN GREAT BRITAIN

PREFACE

HAVING followed the thought and work of Jean Brunhes for many years (and with filial devotion), we undertook in 1934 the difficult task of bringing out a fourth French edition of his *Human Geography*, which, like its predecessors, was quickly sold out. Circumstances have prevented us since then from undertaking a new edition of the work in three volumes, but we had to consider whether we could put off any longer a reissue of the book. In view of its profound influence, and of the growing interest taken in those studies to which Jean Brunhes first gave the name of "human geography," was it not our duty to put the book again at the disposal of the public as soon as possible?

Circumstances compelled us to resort to a temporary solution of the problem. We decided, in fact, to return to a plan for which an arrangement had been made in 1929, but whose realization had been prevented in 1930 by Jean Brunhes' death. This was to issue *Human Geography* in an abridged form, as Emmanuel de Martonne had done in the case of his physical geography.

The book is so homogeneous, such a complete unit, that any alteration in its form or size was attended by some danger. We started the task with anxiety—and with some feeling of excitement—and now that it is finished we cannot disclaim our responsibility both to the author and to our readers. But some responsibility rests also, perhaps, upon those for whom we have laboured so earnestly. The thought of them, ever present in our minds, has constantly encouraged us to persevere.

The author left us explicit instructions, and these have been followed unswervingly throughout. At his death he entrusted to us his manuscripts and books, and we were able to make important decisions with full knowledge. We have been sustained throughout by the eagerness of those anxious to study or re-read Jean Brunhes' work, already a classic. So it is with gratitude, and with some measure of confidence also, that we offer them now this abridged edition of *Human Geography*.

The plan of the present work is the same as that of the previous edition, with similar headings and sub-headings. The outline, or framework, is also similar to what it was before, so that the seeker after a fuller treatment of any subject can pass without difficulty from this abridgment to the original edition.

Jean Brunhes' enthusiasm for the method of "sampling" is well known, and his method has become a sound and indispensable one in modern geographical science. It was therefore not without regret that we decided to leave out two monographs employing this method—namely, Chapters VII and IX, the second and fourth examples of "special studies in human geography." The first of these chapters was concerned with "human islands" in the highlands of the Central Andes (Peru, Bolivia, Argentina, and Chile); upland pasturage and transhumance; oases of cultivation and irrigation. It first appeared in the English edition of *Human Geography*, and was the work of the late Isaiah Bowman, Director of the American Geographical Society from 1915 to 1935, and learned explorer of the Andes, who sponsored the translation of *Human Geography* in the United States (now out of print). This study was included by Jean Brunhes in the next French edition of his book. Unfortunately we found it impossible to obtain the blocks of maps and photographs belonging to this chapter, and as we considered these essential to the text we had to leave out the whole study.

This was a painful decision to make, and so was that to leave out Chapter IX, through lack of space. This chapter, which did not appear in the original English edition, dealt with highways opened in 1923 from Annam to Laos (*i.e.*, from the China Sea to the Mekong)—a kind of road used in new countries—and their ethnographical, economic, and political aspects. This study was the outcome of a long official and geographical mission undertaken by Jean Brunhes in the Far East, and before being incorporated in the third and fourth French editions of *Human Geography* it had appeared in part in the *Annales de Géographie* (vol. xxxii, September 15, 1923, pp. 426–450).

However, by the use of smaller type as well as ordinary type we have saved enough pages to retain many other examples of Jean Brunhes' "samples." We hope, too, that each reader will supplement his reading by well-chosen observations, collected, ordered, and arranged according to the principles and models to be found in this book, which will thus continue to perform one of the main functions assigned to it by its author—to be above all else a work that should awaken ideas and lead to research.

We have shortened some chapters, especially those dealing with vegetable and mineral products, because many special studies have been made of these products during recent years.

Jean Brunhes made it plain on more than one occasion that his book was not a complete manual of economic systems, and that his primary concern was to introduce a few principles of "geographical logic" in the fragmentary sketches in the economic chapters. The essential part of the exposition, which retains all its importance in spite of the changes that have taken place, will be found here.

The abridgment has been done with the greatest care, and the text that has been retained follows closely its original form. Although we have had to make some cuts, we have been careful to see that the exposition is continuous and logical, and that it reads easily. A certain amount of adjustment has been done, so as to take account of recent events, but we have stopped at the years 1937 and 1938 in the case of the countries of Central Europe, especially in the matter of statistics, and generally speaking at the year 1939, so that in many cases what we have to offer is an assessment of the situation on the eve of the Second World War. The author's care in bringing his book up to date for each new edition has led us to add short paragraphs to complete the account of certain developments to which they form a normal continuation, since the sequence of events has confirmed the value of Jean Brunhes' observations and facts.

We have also made a point of including a few passages from other of Jean Brunhes' works, since they are complementary or interesting parallels, and these extracts enable us to show also how often he was an inspirer and a precursor of others. Such works as *L'Irrigation . . . dans la Péninsule ibérique et dans l'Afrique du Nord* (1902), *La Géographie humaine de la France* (vol. i, 1920; vol. ii, 1926), *La Géographie de l'Histoire* (1921), and others written by the author, alone or in collaboration, along with *La Géographie humaine* (first edition, 1910), have been the starting-point of so many new investigations that we have thought it expedient to recall this fact, and to call attention to it when necessary.

The passages that we have added to the book are concerned for the most part with such subjects as "white coal" (the geographical conditions of the transport of electrical energy and the grid system); the sites of ports; the "fundamental seed-bed" of population; geography and air transport; methods of cultivation and stock-raising; the rural landscape and agrarian geography; the civilizing rôle of the vine; the history of edible plants; methods of nomadism and transhumance in Brazil; rayon; industries dependent

on coal and substitute products; irrigation and the great barrages; medical geography and human actions; the part played by nomadism in the spread of disease; and so forth. All such passages are marked by asterisks at the beginning and end.

In all his books Jean Brunhes paid tribute to the efforts of his predecessors, and developed gladly and with pride the original work of his followers and friends. This loyal and scientific attitude is a characteristic of the great scholar and the real master of his subject. We have respected this attitude, and, following such a good example, we have imitated it in our turn. Here, therefore, as in the earlier French editions, will be found a bibliography which, be it remembered, is merely a selection.

An index of the principal subjects dealt with will be found at the end of the book, and this will add to its working value.

We were anxious that the illustrations and maps should be numerous and of exceptional quality, as they have always been, but some of the blocks could not be used again, as they were worn out, and their originals either destroyed or lost, so we have had to replace them by a few new ones.

This abridged edition includes forty maps and diagrams. Of these, fourteen have appeared already in *Human Geography* (either in the complete English edition or in one of the French editions), seventeen are taken from other works by Jean Brunhes, especially *La Géographie humaine de la France*, and nine are new maps, which we owe to the courtesy of R. Blanchard, Doyen honoraire de la Faculté des Lettres, Directeur honoraire de l'Institut de Géographie de l'Université de Grenoble; A. Cholley, Doyen honoraire de la Faculté des Lettres, Directeur de l'Institut de Géographie de l'Université de Paris; M. Larnaude, Professeur honoraire de la Faculté des Lettres de Paris; P. Gourou, Professeur au Collège de France; and Dr Ch. Henry. To all these we give our warmest thanks, the more so because we can thus follow one of the traditions so dear to Jean Brunhes—the tradition of hospitality, which has allowed us to welcome new work by doing homage to its value and importance.

The illustrations comprise one hundred and seventeen photographs, which formed vol. iii of the original French edition. To approximate as far as possible to this arrangement we have placed them all at the end of the text,[1] where they form a little album by themselves, though not separated from the rest of the book. They include seventy which previously appeared in *Human Geography* (either in the English or in the French editions), and of which the very great majority were taken by Jean Brunhes. The other forty-seven are new, and have been either borrowed from notable French or foreign collections of aerial photographs or taken from our own personal collections. We are especially grateful to Mme Jean Thomas, widow of the much regretted young scientist and African explorer, and to R. Clozier, Inspecteur Général de l'Enseignement du second degré, who have lent us photographs.

The introduction of new blocks, together with certain typographical requirements, has compelled us at times to change the order of the illustrations, but beneath each illustration is indicated the page to which it relates, so that each one can still be identified with its place in the text. The illustrations, however, remain strictly subordinate to the exposition of facts and theories.

We have not desired to write a new book, and, despite the necessary alterations and reductions, we believe that we have retained the true spirit of *Human Geography* and its character as a fundamental work of scientific method and investigation.

[1] Between pages 240 and 241.

Jean Brunhes loved to appeal to the testimony of scholars and critics as to the value of his work, and such testimony is still borne throughout the world by the influence of *Human Geography*, the disciples it has made, and the works it has inspired. Its principles and their applications, its explanations and conclusions, all have kept their value: a changing world only confirms the permanence of the work of Jean Brunhes.

Further proof of this is provided by this English edition, for which we are deeply grateful to the publisher and translator. They have assisted very willingly, and with great care and fidelity, in spreading even more widely the still living message of Jean Brunhes.

MARIEL JEAN-BRUNHES DELAMARRE
PIERRE DEFFONTAINES

PARIS, 1952

CONTENTS

ILLUSTRATIONS

PLATES IN HALF-TONE

MAPS AND DIAGRAMS IN THE TEXT

Chapter I

HUMAN GEOGRAPHY AND ITS RELATION TO PHYSICAL GEOGRAPHY

1. The Proper Sphere of Geography

Physical Geography and Human Geography

THERE is a double zone that constitutes the proper sphere of geographical study—the lower stratum of the atmospheric envelope that surrounds the earth and the solid crust of the earth itself. At all points where these two concentric zones are in contact with each other three groups of primary phenomena are produced.

(*a*) The heat of the sun is the great source of all activity and all life on our earth, and its principal effects are accumulated where the atmosphere and the crust of the earth are in contact. The 'heating surface' of our atmosphere is the surface of our own earth.

(*b*) It is also at the point of contact of the atmosphere and the earth's crust that such atmospheric occurrences as changes of temperature, wind, and rain, and particularly those geographical phenomena to which they give rise, such as streams and glaciers, are incessantly at work to break down the heights and fill up the depths.

(*c*) Lastly, it is on the surface of our globe and in the lower stratum of the atmosphere that all forms of vegetable, animal, and human life are concentrated.

Birds come to earth to rest or to feed. Fish and the invertebrates even of the deepest seas nevertheless live comparatively very near the surface. And human beings display in the highest degree this essential localization of life in two shallow concentric strata—one of rock or water and one of air.

This 'place' in which all these essential phenomena are mingled or superimposed one upon another marks off the geographer's sphere of observation, and is the primary domain of geography. Most of these phenomena are entirely exempt from all human influence. Whether man exists or not the water of the seas and lakes will go on evaporating for ever, and the torrents of running water will always be able to carve out grooves in the earth. So also a great deal of vegetable and animal life is not susceptible to man's influence. Even if man did not exist the earth would still have a plant covering and an animal population. And this purely 'natural' part of biological geography, both vegetable and animal, may also be included in physical geography, in the widest sense of that term.

But a general glance over the earth reveals an entirely new and very abundant set of surface phenomena: there are towns and railways, cultivated fields and quarries, canals and irrigation tanks and salt-pans; and here and there, in particular, there are masses or groups, of varying density, of human beings. These human beings are themselves surface phenomena, and therefore geographical. They live on the earth; they are subjected to atmospheric and terrestrial conditions; they belong to certain climates, certain altitudes, and certain zones. Moreover, they live on the earth in another sense also, for it is by submission to natural phenomena that they obtain sustenance for their bodies and provide for the development and expansion of their faculties.

What are the mounds and ant-heaps built by the termites compared to man's own works on the earth? In geography the difference between what is done by animals, even

the most highly gifted, and the things that man alone has done is startling and immeasurable. Man, by afforestation, can temper the destructiveness of floods and change the climate. He plants the sea-pine to steady the shifting sands, and the grass-wrack to stabilize the mud beneath the sea. Among living creatures he can regulate and control many artificially selected breeds; he can cultivate plants and domesticate animals. All these phenomena in which human activity plays a part form a very special group among the surface phenomena of our planet, and to the study of this class of geographical facts we give the name *human geography*.

2. The Principle of Activity

Geographical Phenomena, both Physical and Human, are in a State of Perpetual Change, and must be studied from that Point of View

Everything around us is in a state of change; everything is either growing or diminishing; nothing is really stable. The level of the sea, the universal and traditional datum-line for the measurement of heights, is but an average level, purely imaginary and often varying. The vast icefields, despite their apparently eternal stability, are yet subject to slow but continuous movement. The loftiest peaks will sooner or later be reduced to more moderate heights. What, then, are the forces which are unceasingly transforming the surface areas of our globe?

(*a*) The forces within the earth are revealed either by very slow and scarcely perceptible but very protracted phenomena, such as the rising, falling, and folding of the surface, or else by sudden occurrences like earthquakes and volcanic eruptions. Changes of the first kind proceed so gradually that they are scarcely perceptible by a single generation of men, but it would be a grave mistake to ignore them. The second kind startle us by their strange suddenness, and we are liable to overestimate their importance. But in reality both kinds of phenomena are only a minor part of the present activity of the earth, compared with those daily changes which take place everywhere and every day, caused by the action of the sun.

(*b*) The sun's heat is the prime source of the energy that gives rise to almost every kind of activity to be seen on the earth. The sun dominates our globe through the temperature-changes that it is continually causing. These temperature-changes produce changes in pressure and instability of innumerable kinds, and this instability gives rise to movement.

(*c*) But here intervenes another set of forces, transforming and directing and multiplying these atmospheric movements. For the earth does not rest motionless in space: it is impelled by periodic movements that are every day and every moment changing its position in relation to the sun; and by these movements the sun is enabled continually to vary its field of action on the earth. So, as permanent multipliers of the smallest daily changes, they should be regarded as a third source of activity. At the same time, it is only perpetual changes in the conditions of equilibrium on the earth that are produced by these transforming forces: it is always the sun that provides the *energy* which is the prime cause of these changes. Light and heat, rainfall, climate, and the seasons—all these we owe to the sun. And the sun has even created on the earth what may be called reserves of force, which man can draw upon at his pleasure; in coal there is, in fact, stored up an incomparable supply of energy.

(*d*) On the terrestrial globe, therefore, solar radiation is a ceaseless cause of

disequilibrium, and consequently of movement. But this movement would be disorderly if there did not exist a general cause of order to counteract this cause of disorder. This force, which I shall call the 'wise' force of the earth, in contrast to the 'foolish' force of the sun, is the centripetal attraction of gravity. It imposes on bodies of different weights and densities a single order of stability and a single form of equilibrium, and from this contest between an unwearying source of activity and a source of inviolable order there finally results a single uniform product. This attraction of the heaviest bodies towards the centre of the earth controls and organizes activity, and thus a system of harmonious order is introduced into the general economy of our earth.

We begin by observing mechanical phenomena that occur together; then we find that these phenomena are really subordinate one to another; and finally we discover a principle that unites them. Thus we can legitimately arrive at the idea of relationship, and seek to enunciate laws. In this way, instead of being restricted to the mere observation of phenomena, we are led to study them in series and to seek for the principle that connects them. Every sequence has its causes and its laws, and thus phenomena in the material sphere acquire a kind of personal life, having not only maxima and minima, but birth, maturity, and decay, and therein lies one of the newest and strangest branches of geography.

For a century now it has no longer been customary to classify mountains according to such secondary or accidental characteristics as their direction or height. It has been recognized that their formation dates back to different periods in the earth's history, and so for the first time the notion of age has been introduced into orography. Mountains are no longer merely structures of different dates and origins: they can almost be compared in their development to living organisms. No longer are they simply older or younger than each other: they are also old or young in relation to their past and future forms. Age in orography is shown by topographical features. No continental mass can escape erosion, whose progress is inevitable, so the actual stage of erosion will enable us to give to its present topographical condition a definite place in the necessary series of successive states.

When we speak of the age of topographical forms we should speak also of the age of water-courses, for streams, like mountains, are of different ages. They all pass through various phases, whose sequence constitutes a cycle—a *cycle of erosion*—which W. M. Davis goes so far as to call a *life cycle*. They pass from infancy, characterized alike by an indeterminate flow and a series of torrents, to a period of old age, marked by twistings and turnings and branchings of all kinds. When a river has reached the state of decrepitude it may be suddenly compelled, by the lowering or displacement of its base-level, to begin all over again its task of excavation *in the opposite direction*, and in so doing it may even recover the vigour of its earlier days, though it will none the less retain to some extent some of its marks of old age. It had become more and more sluggish, as if in a long sleep, but it may wake up suddenly, though without completely 'putting off the old man.' So it is that in a thalweg in a slightly undulating area of very low relief, where one would expect to find a weak and sluggish stream, there is sometimes a newly embanked river flowing strongly and energetically. Rivers and valleys may pass in succession through several cycles—as is most commonly the case—which *morphology*, the science of forms, endeavours to perceive and distinguish.

It is said that the flora and fauna of a country grow old or renew their youth, and when they change it is said that they grow rich or become poor. The settlement of an area and the development of an urban centre are marked by sequences of phenomena resembling those that characterize living beings. What does it matter whether a town has a population of 50,000 or 52,000? That is not the important question. But what is its past history, and what is its rate of growth? What stage of development has it reached? Has it arrived at, or passed, the period of full bloom and maturity? Those

are the questions to be asked and answered. Is it an old city that used to boast of 100,000 inhabitants and to-day has no more than 5000? Is it a Ravenna or an Aigues-Mortes? Or is it, on the other hand, quite a young town, born but yesterday, and now in vigorous growth?

In 1840 there were only a few fishermen's dwellings on the half-liquid mud of the Whangpoo and the lower Yangtse. In the same year, on the bare and rocky islet of Hong Kong, to-day both populous and verdant, there were a few huts and pirates' dens. Development began in both towns in 1841 or 1842, so that they are but a century old. Shanghai is to-day a community of more than four million people, the biggest city in China, and Hong Kong, with its dependencies, has a population of well over a million.

Nothing could be more striking than the growth of Paris, so far as the figures can be approximately established from historical records, as follows:

Date A.D.	Historical Period	Population
363	The Emperor Julian	8,000
510	Clovis	30,000
1220	Philip Augustus	120,000
1328	Philip VI	250,000
1595	Henry IV	230,000
1675	Louis XIV	540,000
1788	Louis XVI	599,000
1801	The Consulate	548,000
1817	Louis XVIII	714,000
1831	Louis-Philippe	786,000
1851	The Republic	1,053,000
1856	Napoleon III	1,174,000
1861	(After the absorption of the suburbs within the outer fortifications)	1,696,000
1866		1,825,000
1872		1,794,000
1876		1,989,000
1886		2,345,000
1896		2,436,000
1906		2,763,000
1911		2,847,000
1921		2,906,000
1931	City, 2,891,000; Greater Paris	4,887,000
1936	City, 2,830,000; Greater Paris	5,130,000

Whereas Paris grew between 1801 and 1911 from 548,000 to 2,847,000—a fivefold increase—the rest of the Department of the Seine, excluding Paris, grew during the same 110 years from 84,000 inhabitants to 1,222,000—a fifteenfold increase. And between 1931 and 1936 the population of Greater Paris continued to increase, though that of Paris itself showed a slight fall.

At the beginning of the twentieth century Europe contained about a hundred and sixty towns of more than 100,000 people, of which fifty-five had populations in excess of 250,000; the 'half-million' towns numbered twenty-three and the 'million' ones six. A. de Foville was right in summing up as follows: "There are more cities in Europe to-day with upward of 500,000 inhabitants than there were cities of 100,000 a century ago."[1] There were in Europe in 1940 sixteen towns of a million inhabitants, twenty-nine of half a million, and 236 of over 100,000.

[1] A. de Foville, "Les grandes villes au XIXe et au XXe siècle," in the *Économiste français*, June 13, 1908, p. 877.

So quickly do the facts about urban areas change that it is no longer true, as it was as recently as 1921, that London is the biggest city in the world. Including suburbs, the first city in the world is New York; London is only second. The figures in 1934 were respectively 13,906,000 (without the suburbs, 7,380,250) and 8,575,000.

There are great differences also between two approximately similar aggregations of human beings, such as the 274,000 inhabitants of the whole Department of Lot-et-Garonne (according to the 1906 census) and the 252,000 of the single city of Bordeaux (at the same census). Not only are these groups congregated together in the one case and scattered in the other, with quite different conditions of labour and localization binding them to the soil in quite different ways, but besides that, and more important, sixty-five years earlier (1841) the Department had 72,000 *more* inhabitants, while the city had 153,000 *fewer*. And thirty years later, at the 1936 census, the position had changed again, for the population of Lot-et-Garonne had fallen to 252,700 and that of Bordeaux had risen to 258,300.

So there is constant progress and recession. These human phenomena, like all terrestrial phenomena, never remain the same. They are all actuated by definite movement, and they must be studied as one studies moving bodies—by determining the place and time at which they begin, and then indicating the direction and speed of their movement.

3. The Principle of Interconnexion

Geographical Phenomena are closely bound up with One Another, and must be studied in all their Numerous Combinations—The Concept of the 'Terrestrial Whole'

It is not enough to study separately these various sets of phenomena, for they are not really separate: they are closely connected with one another. The idea of interconnexion should dominate every complete study of geographical facts. We must not be content with observing one fact by itself, or an isolated series of facts. After this preliminary observation our task is to place the series in its natural setting—that is to say, in the complex group of facts within which it has been produced and has developed. We must find out how it is connected with other phenomena around it, to what extent they are determined by it, and how far it has been influenced by them. In meteorology, in zoology, and in botany it is possible to isolate certain facts and study them entirely by themselves, but in geography we cannot be content with this method. And the curious thing is that this principle of interconnexion, employed with particular success in geography, has even penetrated now into these special sciences, so that we have seen the creation of botanical geography alongside of botany, and of zoological geography in company with zoology.

Systematic botany collects and classifies plants by genus and species, and draws up lists and makes herbariums, country by country; and this preliminary study is essential. But it cannot be denied that even if specimens are sought for, selected, and examined with the most painstaking care the region itself, regarded as a natural botanical region, is somewhat neglected, as is shown by the importance attached to a rare plant, even if it is represented by two or three individual specimens only.

The plant covering of a natural region has certain dominant features—a physiognomy, as it were—and for the geographer a list of only the most numerous plants, in their order of importance—*i.e.*, the *vegetation*—has an entirely different interest from the *flora*, which is the complete list of morphological types. The former reveals to a greater extent the general conditions of life, and thus has biological value.

Such are the first principles of botanical geography. Interest is transferred from isolated individuals or units regarded as species of a flora to groups of two main kinds—namely, *forms of vegetation* and *plant associations*.

Forms of vegetation include plants which, though morphologically very different, are similar in appearance and manner of growth. The commonest of these classes, empirically described, are *trees*, *bushes*, *herbaceous plants*, *epiphytes* (plants which grow on other plants), and so forth. To use the term employed so often by Alexander von Humboldt, the real founder of botanical geography, these are properly called *physiognomic* categories. Now, this brings us already nearer to geographical reality, for it enables us to keep next to each other plants which would be separated by systematic classification, such as the two kinds of thick-leaved plants found together in dry regions—namely, the succulent-leaved aloes and the leafless cactus with succulent stem. On the other hand, the former classification of species has been broken down by this method; thus the mighty and superabundant family of *grasses*, which includes the gigantic bamboos of the tropics as well as maize and rice and the rye-grass of our own meadows, has become completely upset, with its genera and species distributed among several different *forms of vegetation*.

The second group employed in plant geography shows still more clearly the facts of natural interconnexion. The plant world, as we have said, gives to certain similar countries a similar appearance: different plants actually have resemblances in character, and also some kinship. The whole of those plants which live together and whose natural grouping is shown by a characteristic kind of landscape constitute a *plant association*. The great trees of our own lands, such as beeches and firs, grow in huge *forests*, each kind accompanied by the same group of shrubs, grasses, or mosses forming everywhere the same kind of undergrowth—a sort of compulsory band of retainers. And the whole of this living group is known collectively by the name of the tree or species which dominates it; as the plant association of the fir, the plant association of the beech, and so forth. In this way an entirely new botanical science has been created, giving more attention to the actual grouping of living forms.

It would be possible to show many other relations between the animal world and the same natural conditions of soil and climate, between the plant and the animal worlds, and between types of animals. But for the moment I merely note this general and necessary aspect of research of various kinds. In his work *Domestic Animals and their Relation to the Economic Life of Man* Eduard Hahn not only studies domestic animals individually and investigates their origin, but considers them also in their geographical environment. He examines the relations between animals and cultivated plants, and determines with what forms of soil exploitation, with what kinds of cultivation, and with what types of economic organization these animals are generally associated.

From these methods of cultivation, these facts of animal distribution, and these types of economic organization we are led on logically to consider man himself. Our efforts are based fundamentally on the great geographical principle of interconnexion, for men, like plants and animals, are closely connected with certain phenomena. Many typical instances of this will be described, or at least mentioned, in this book. For example, man needs water, both for himself and for the animals that live around him, so he makes his abode near to springs, and thus the distribution of springs often throws light on the distribution of human habitations. In Lorraine, for instance, a line of springs follows the line of contact between the permeable lower oolite and the impermeable clay of the lias, and towns and villages are strung out along this line. In other cases men have congregated on the frontiers of very dissimilar natural regions because these frontiers were of necessity the natural places for trade. Thus the volcanic heights of the Auvergne, which is pastoral country, are bordered on the north-east by the rich agricultural plain

of the clayey Limagne, and surrounded elsewhere by crystalline regions—poor areas of moorland and chestnut groves. The most important towns—Riom, Clermont-Ferrand, Ardes, Saint-Flour, Aurillac, Pleaux, Mauriac, Riom-ès-Montagne—are situated on the fringes of the old volcanic area, and form an urban girdle never far removed from the geological line of demarcation.

"The importance that we attach to the study of Quaternary glaciation [writes Paul Girardin] arises from the fact that in Savoy, as in other mountainous regions, physical and human geography are for the most part the work of ancient glaciers. It is they that have enlarged, deepened, and shaped the Alpine valleys, even if they did not excavate them, and it is they too that have made the mountains habitable. In fact, the deposits of erratics, being impermeable (especially the glacier mud of the deep moraines), mark out on the sides of the valleys a line of springs, and at the point of contact there reappear the waters absorbed by the banks. This feature enables us to recognize them in the landscape. On the other hand, these glacial ledges, as Kilian calls them, made up of materials from different sources, contain elements of all kinds, such as limestone in a granite country and silica in an area of chalk, always in a very advanced state of attrition, so that the soil they produce is highly cultivable—often, indeed, the only usable soil in the valley—and this gives them their privileged position as favourable spots to be chosen for human settlement. It was noticed earlier by Loewl that in the tributary valleys of the Oetzthal habitation on deposits of volcanic debris reached a maximum in regard to number of inhabitants per square kilometre—84 per cent. in the Langtaufererthal and 94 per cent. in the Valserthal. We shall show that habitation on the moraines exceeds this in the high mountain regions.

But there is a still closer connexion between these Quaternary moraines and human geography. Lateral moraines in particular preserve the slope of the ancient glacier. This slope, though scarcely steeper than that of the valley whose bottom they overlook, is shallower than that of the glacier itself. They join upstream what remains of the old glacier, usually in the form of a hanging glacier. There are embankments, continuous and projecting, obviously suited, on the impermeable glacier mud, to carry irrigation canals. These canals, called *bialets* or *bialières*, spread and branch over the frontal moraines, sometimes covering the whole base of a small valley, like the valley of Polset above Modane or that of Chavières-sur-Pralognan. There is enough remaining of these ancient canal systems to show the connexion between irrigation and the moraines of the ancient glaciers."[1]

The situation, configuration, structure, or climate of a region may help to explain the historical development of a people, or their social organization. In the case of some states, such as England, this is commonly recognized. But it is possible to find real natural foundations for political facts that have long been considered rather surprising and abnormal. Thus Professor Theobald Fischer has clearly explained, in a notable book on the Iberian Peninsula,[2] the reasons why Portugal has managed to preserve her historical and political autonomy.

Portugal is simply one of those peripheral zones, like the plains of Valencia or Andalusia, that surround the central plateau of Spain; but Portugal alone is separated from Spain by erosion gorges—deep canyons carrying three great streams and their tributaries—forming a more effective natural frontier than many mountain ranges. Moreover, Portugal is far more closely connected with the sea than any other part of the Peninsula. Through the great river-mouths the sea penetrates far inland, and Portugal has lived her own life because her products are the same as those of some other parts of the Peninsula, and she has had, therefore, to turn towards the sea and away from Spain. Fischer makes an illuminating comparison between Portugal's independence of Spain and Holland's independence of Germany.

[1] Paul Girardin, "Glaciation quaternaire," in *Revue de géographie annuelle*, ii (1908), pp. 691–692.
[2] *Die Südeuropaeischen Halbinseln* (Vienna, Prague, Leipzig, 1893).

This method, followed by my master, Vidal de la Blache, is clearly explained in the Preface to his *Atlas*:

"The political map of the country to be studied is accompanied by a physical map. These maps elucidate each other, and are supplemented by maps or diagrams relating to the geology, the climatology, and the statistics of the region. The object of this dossier—if the term may be allowed —that is more or less complete according to circumstances, is to give a general view of the characteristic features of a region, so that a connexion can be established between them. This connexion, indeed, is what constitutes the geographical *explanation* of a region. The features that make up the appearance of a country, regarded in isolation, are valuable as facts, but they acquire value as scientific concepts only if they are set in the series to which they belong, and which alone can give them their full significance."

[And again] "Whether the facts be climatic, botanical, or economic, it is the relation between them that I have sought to discover. Where certain climatic conditions, certain forms of vegetation, and certain groups of products are to be found, that is the geographical element which enables us to establish a connexion with the soil. So the characteristic of a region is a complex thing, resulting from the whole of a large number of features and from the way in which they combine and modify each other."

It follows, therefore, that we should never confine our attention to one order of phenomena. Even the smallest geographical study, if it aims at completeness, cannot be limited to the observation of isolated facts. There are no watertight compartments on the earth's crust: there may be partitions, but there are no walls. A mountain is not a single, self-contained entity; a town is not an independent unit, but depends on the soil that bears it, the climate that it enjoys, and the environment on which it subsists; a river is not an individual living to itself alone. "No part of the earth," says Vidal de la Blache,

> can be explained by itself alone. Not only that, but the full working of local conditions can be clearly discovered only to the extent that observation reaches beyond them and can include analogous cases that lead naturally to terrestrial laws of general application. The Alps cannot be studied without a study of the other ranges of folded mountains of recent date, nor can the Sahara be studied apart from the other deserts of the earth.

Such great meteorological phenomena as trade winds, monsoons, and cyclones are striking manifestations of the close interdependence of the different parts of the earth.

And so we arrive at the highest concept of all, that of the 'terrestrial whole,' or the unity of the entire globe. Different forces do not act upon one another only in determined

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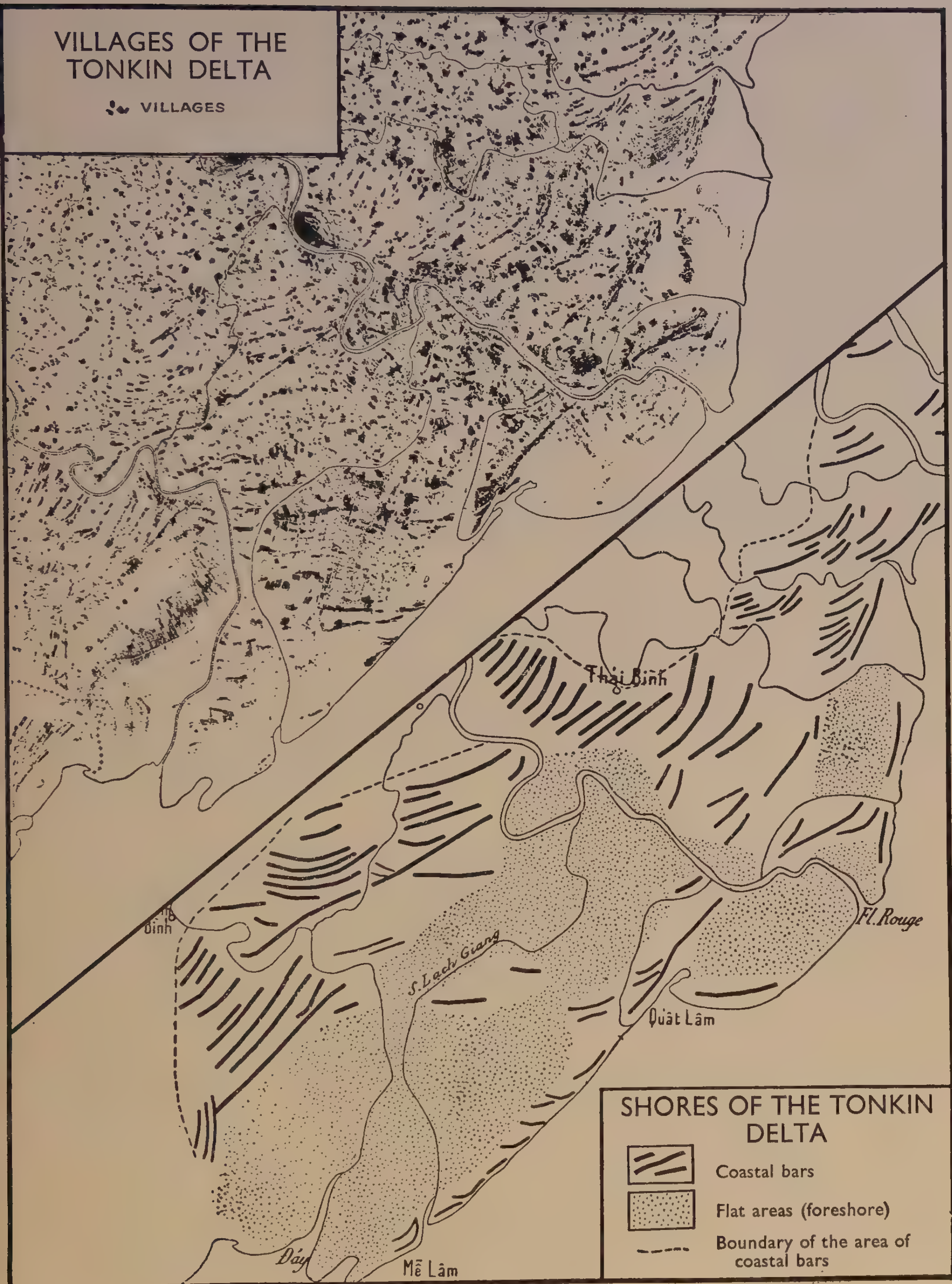
**Maps I and II*

General Connexion between Physical and Human Geography as shown by the Distribution of Annamite Villages on the Coastal Bars of the Tonkin Delta

The Annamite villages of the Tonkin delta have been built on the alluvial ridges along the river and on the coastal bars particularly suitable for human settlement owing to their height and the dryness of their soil. The coastal bars, formed by the action of the current washing down the alluvium from north to south, are shown in Map II, taken from the hypsometric map (scale, 1/25,000) of the Indo-China Geographical Service. This latter map shows only the most important of the bars—those more than one metre in height—but the existence of lower ones is just as interesting to notice: we need only examine the distribution of the human settlements and their 'lay-out' on the map of the delta villages, which follows the very outline of the coastal bars. Thus the 'human' map supplements the 'physical' one, and the conclusion drawn by Pierre Gourou is that it is useful to follow the study of the coastal bars on the map of the villages. And, conversely, we can say that the human settlements should be studied in close connexion with the facts that fall within the scope of physical geography.

*Reproduced from Pierre Gourou's study of the peasants of the Tonkin delta, by courtesy of the author and the publisher (Ed. d'Art et d'Histoire)**



MAPS I AND II

[See opposite for legend.]

conditions; it is not only in a few defined cases that they act reciprocally. In fact, it can still be maintained that in a more or less distant manner, and in a more or less visible form, each of these forces is bound up with all the rest, because of the countless interactions of the conditions brought about by them.

Claude Bernard wrote as follows in his *Introduction à la médecine expérimentale* [1]:

> "It must be recognized that determinism in the phenomena of life is not only a very complex determinism, but at the same time a determinism that is harmonically organized, so that complex physiological phenomena are formed by a series of simpler phenomena which determine each other by associating or combining for the attainment of a common end. Now, the essential object of the physiologist is to determine the elementary conditions of physiological phenomena, and to grasp their natural subordination, so as to understand and then follow their various combinations in the very varied mechanism of animal organisms. The ancient emblem that represents life by a circle formed by a serpent biting its own tail is an appropriate symbol, for in complex organisms the structure of life does indeed form a closed circle, though it is a circle with a head and a tail, in the sense that vital phenomena are not all of equal importance, although one follows another in making up the vital circle. Thus the muscular and nervous systems keep up the activity of the organs that prepare the blood, but the blood in its turn feeds the organs that produce it. There is an organic or social solidarity that maintains a kind of perpetual movement until some disorder or failure on the part of some necessary vital element disturbs the equilibrium and upsets or stops the working of the animal machine."

The term 'terrestrial organism' no doubt sounds too bold, but we may none the less borrow Claude Bernard's expression and say that there is an "organic or social solidarity" between all the phenomena of the 'terrestrial machine.' In the examples previously given the solidarity might be regarded as a particular or local solidarity, but we are speaking now of a general and universal solidarity. And what, after all, is this but the notion of interconnexion, developed, enlarged, and widened? To quote Vidal de la Blache again: "The notion that the earth is a unit with co-ordinated parts provides the geographer with a methodological principle which will be found more fruitful the more it is applied."[2]

Activity and *interconnexion* are therefore the two principles that must dominate geography to-day. The forces of physical nature are bound up together in their consequences, in their relations, and in the consequences of these relations. Nor is man himself exempt from the common law, for his activities are included in the network of terrestrial phenomena. But if human activity is thus part of a wider whole, it does not follow that it is fatalistically determined. By their connexion with the phenomena of nature man's activities are included in the domain of geography in their own right. But they have a further title to inclusion, for, besides being subject to the influence of certain phenomena, they also exert influence in their turn. For that reason we are entitled and obliged to add to those material forces which we have seen continually in action this new force, not entirely of a material nature, though it shows itself in material effects—the force of human activity. That is why we are led as geographers to study man's actions in nature, without ever separating them from the study of natural or physical geography.

[1] Pp. 151–152.

[2] "Le Principe de la Géographie Générale," in *Annales de géographie*, January 15, 1896, p. 129.

Chapter II

GROUPING AND CLASSIFICATION OF THE FACTS OF HUMAN GEOGRAPHY

1. Antecedents and Beginnings of Human Geography Proper

The Direction given to it by Ratzel

MODERN geography aims at the comparison and classification of phenomena, and endeavours to explain these in the widest sense of the word 'explain.' Ancient geography was defined as a *description* of the earth, but modern geography is really the *science* of the earth, not content with describing phenomena, but desiring to explain them. It studies the various forces at work on the earth, in their development, their manifestations, and their consequences, and then it studies the relations between them and the consequences of those relations. Modern scientific geography, as we have just said, is dominated by two main ideas—*activity*, on the one hand, and *interconnexion*, on the other. It is now no longer an inventory; it is a history; not an enumeration, but a system. It has the twofold object of observing, classifying, and explaining both the direct effects of the forces at work and the complex effects of these forces in combination.

We have to come right down to the nineteenth century to find the real rebirth of geography. At the beginning of that century two men set forth clearly the guiding principles not only of that part of geography that was to become physical geography, but also of what was to become human geography. One was the great savant, observer, and innovator Alexander von Humboldt (1769–1859), author of *Cosmos*. The other, more of a philosopher and historian, was dominated always by the teleological obsession which led him, despite some exaggerated ideas, to seek everywhere for affinities and connexions between man and the earth. This was Karl Ritter (1779–1859), author of the *Allgemeine vergleichende Erdkunde* [*Universal Comparative Geography*]. These two names should be associated in a common act of homage at the beginning of any modern attempt to establish the method of geographical investigation.

Then in 1882 Friedrich Ratzel published the first volume of his *Anthropo-Geographie*. He was not, it is true, the first to adopt this method of considering and analysing human phenomena, for as far back as the writings of the greatest Greek historians and philosophers we can find true and ingenious reflections which, though very fragmentary and scattered, enable us to invoke the ancient authority of Herodotus and Thucydides, Hippocrates and Aristotle, in support of this very youthful branch of geography. Ratzel followed tradition above all things, and developed, though with greater precision, the general ideas of Karl Ritter. But by inventing a name to denote these new studies he contributed more than anyone else to the success that has attended this kind of research.

To Ratzel men appeared as things that covered parts of the earth's surface, as with a living carpet, just as worthy of the geographer's attention as the carpet of vegetation or the animal population. He saw human groups and human societies growing up always within the limits of a certain natural framework (*Rahmen*), occupying always a precise place (*Stelle*) on the earth, and needing always a certain amount of space (*Raum*) to enable them to be fed and to live and grow.

In January 1904, some months before his death, Professor Ratzel gave me himself the following account of the characteristic development of his career: "I travelled, I sketched, and I described, and that led me to the *Naturschilderung* ('delineation of nature'). Meanwhile I returned from America, and was told that geographers were needed, so I put together and arranged all the facts that I had myself observed and collected about Chinese immigration into California, Mexico, and Cuba, and compiled from them my qualifying thesis on Chinese emigration."

And so by a treatise on human geography the future author of *Anthropo-Geographie* found university professorships open to him. But he was one of those who are convinced—and quite rightly—that all serious and sound human geography must be based on physical geography.

It is no easy task to observe and explain natural phenomena, but it is even harder to observe and analyse the facts of *human geography*. The gift of observation, though indispensable, is not enough: it is impossible to make a success of human geography without a good historical, economic, and philosophical education. And Ratzel's mind was unquestionably well equipped in this respect. He was fruitful of ideas, and it is no less true that he had a superabundance of thought rather than a methodically disciplined mind. His works, and particularly the later ones, are not sufficiently free from dissertations unconnected with geography, and those who have followed Ratzel's teaching should strive to fill up the chief gap in his work by seeking for practical principles of observation and establishing a method of classification. He was very fond of quoting Ritter and appealing to his "comparative geography," and the names of these two deserve to be placed side by side.

In France the renascence of geography was slow, and in the period preceding the deep and far-reaching transformation that will always be associated in particular with the name of Vidal de la Blache our teaching remained wedded too long to an unfortunate routine.

Geography was taught to children and young people in text-books without pictures or maps; atlases were unknown, and sometimes even forbidden. It would be a mistake, no doubt, to judge the development of a science only by the way it is commonly taught, but the kind of teaching does at least provide us with certain information. We can, and should, however, take account of the efforts that have been put forth, and of the immense progress that has been made.

It must, indeed, be said that the influence of Vidal de la Blache has been definitely fruitful: the French geographical school, placed by foreign scholars to-day in the first rank, is undoubtedly to a large extent the result of his teaching and his books.

2. The Facts of Human Geography arranged in Order of Increasing Complexity

From the Geography of the Prime Necessities of Life (Fundamental Physiological Needs—Food, Sleep, Clothing) to Political Geography and the Geography of History in the Widest Sense

Certain requirements of human life are so universal and so uniform that they must be fully met, and admit of no incomplete or intermittent satisfaction. Thus wherever men live and whatever their manner of life they need in the first place air to breathe. Similarly, because of the force of gravity they need something material and solid to rest on, whether it be *terra firma* or in exceptional cases the deck of a ship or an aeroplane. These requirements operate first and foremost to restrict the area of the habitable earth,

as we noted at the outset, to the zone of contact where the solid surface joins and touches the atmosphere.

But there are other material requirements, indispensable to human life, which are capable of being very differently met in different parts of the earth. To recall these is to indicate the causes and the chief forms of those constant relations that men are obliged to establish between themselves and the nature that surrounds them. In proportion as human needs become less crude and more complex, we shall find groups of more and more complicated and confused geographical phenomena coming up for our attention. If we begin by glancing over the whole of this complex and heterogeneous area, taking first the humblest and most elementary facts, we shall then have to try to determine as precisely as possible what are the essential and positive facts that human geography requires us to observe first, and to which we shall always have to give the first place.

(*A*) Geography of the Prime Necessities of Life

(i) Man is unceasingly in need of food. Several times a day he has to renew his bodily strength by eating and drinking. It is in the so-called thirsty lands—regions short of water—that we fully grasp man's complete dependence on water. Even those who seem most independent of local conditions and are free from the geographical captivity of our settled mode of life—the great pastoral, nomadic races—are not free from the tyranny of water. All their journeying, all the planning of their routes, and all their raiding expeditions must take into account first of all the 'water-points,' and the replenishment of their water supplies remains the most constant and serious of their daily problems. Water is everywhere the sovereign ruler of human activity. In the matter of food, this is drawn from plant or animal products provided by living organisms occupying a place on the surface of the globe. Better still, the animals on which men feed are themselves provided with food either by plants or by other animals which feed on plants. The geography of nutrition is linked up not only with the general geography of life, but with the special geography of plant life. Ultimately and essentially, by more or less lengthy transmutations, almost everything that human beings eat will be found to contain some portion of the plant covering of the earth. So a human being's meals represent, directly or indirectly, the harvest, as it were, of a more or less limited area of the plant covering of the earth, either wild or cultivated. And so also when men feed on fish they make their daily meals—indirectly—of a certain part of the organic pasture of the sea that is called *plankton.*

Whenever men eat or drink, therefore, they profit by the modifications they have made in the surface phenomena, and by the constant repetition of their meals they cause constant geographical changes. They are thus bound by regular and periodic material relations to many surface phenomena which are in close dependence on the general and local conditions of soil, sea, and climate. So when food and drink are drawn from it every day and several times a day by some two thousand millions of human beings the earth's surface is subjected to vast and infinite changes and renewals that are literally immeasurable. Thus there is a twofold series of geographical phenomena attached to the geography of nutrition.

(ii) Every healthy human being loses consciousness for a longer or shorter time every twenty-four hours: he goes to sleep. The life of civilized man is so organized that the satisfaction of his essential needs is secured by simple and normal means, and we find it difficult to realize what the periodic tyranny of sleep must mean to the savage, for this

surrender of himself makes him an easy prey to those who want to attack him, whether other men or animals. So all men everywhere have to find some kind of shelter. It may be as rudimentary as can be imagined, like the intertwined branches and creepers made in the thick leafage of the equatorial forests by the pygmies of Central Africa, or a rock-dwelling like those of many prehistoric and existing races, or a hole in the snow, as used by the Eskimo. But in every case there is some precise spot on the earth's surface where man settles down for a few hours, and to which he is naturally inclined to return. Such is the foundation and origin of that important fact of human geography, the shelter or dwelling.

(iii) The human body must be kept at a certain temperature, in the neighbourhood of 98·2° F. (37° C.). Temperatures that are too low prevent life altogether, and because of this organic necessity very high latitudes, like very high altitudes, are the natural limits of human life. None the less the human organism has a marvellous power of reacting against climatic conditions, especially if it is assisted in its defence against loss of heat by clothing. So for people in many parts of the earth clothing meets a vital need, not only in the zone of extreme cold, but also in dry desert regions, where clothing protects men alike from excessive heat, from nocturnal radiation, and from evaporation. But obviously there are places on the earth where men can live without clothes, such as the warm and humid zones. The need to cover his body is far less universal and dominant than man's need of food and sleep, but geographically this need is of great importance, for man clothes himself almost everywhere with animal or plant products, such as feathers, skins, leather, leaves, or bark, and is thus still dependent to some extent on his natural environment.

Food, *a dwelling*, and *clothing*—such, then, are the three essentials of what is called economic geography. But these human facts are of interest to us not only because of all the activities to which they give rise, but also on their own account, and we must try to discover which of them are most interesting geographically.

Of the facts enumerated, those which are least dependent on the geographical setting are undoubtedly those relating to clothing. Clothes do not have to be renewed every day, like food: once made, they last. Clothes, too, are by definition movable and transportable: they are not fixed to one spot like a dwelling. Being thus freed from this twofold servitude—constant renewal and localization—they are freed to some extent from the rigorous tyranny of immediate natural conditions.

Food has to be constantly renewed, and is, as it were, a material link that has to be established at fixed hours between man and the earth, though many kinds of food are easily transportable. When methods of transport are increased, improved, and made easier there is a tendency for the things that man consumes to become more and more varied.

A dwelling does not have to be renewed every day: it is fixed, and occupies a precise point in space. It has a double advantage from the geographical point of view—that it is something often of considerable size that generally makes use of natural resources from quite close at hand, and that it is a durable object on a fixed site. Movable dwellings, such as the nomad's tent, share with clothing the characteristic of being easily transportable, and geographically they are a kind of clothing.

As a fixed and localized phenomenon a dwelling is pre-eminently a geographical phenomenon. Of all the phenomena connected with the satisfaction of essential human

needs it is the one with the greatest geographical significance, and we shall see before long that it has to be an object of very special consideration. In the geographical hierarchy of human phenomena dwellings hold an exceptional place. They do so all the more because every form of human labour on the earth's surface involves the setting up of buildings of some kind, even if only temporarily or from time to time. There is no geographical work of man at a point in space that has not dwellings attached to it, placed near it, or superimposed on it. Everything leads ultimately to the house and the collection of houses called a town or village, so that at the very end of every study of the phenomena of human geography, whatever they may be, we shall be compelled to examine and determine how these phenomena are represented also, as corollaries or consequences, by houses scattered or massed together.

(*B*) Geography of the Exploitation of the Earth

We have spoken so far—quite intentionally—of the material things which satisfy the prime needs of human life, without examining the ways in which men provide for the satisfaction of these needs. They are not content everywhere and always to gather wild fruits to feed on (simple fruit-picking) or to kill wild animals (hunting and fishing): they take thought and busy themselves in a marvellous way to procure animal, plant, and mineral products in advance, for future use. While obeying always the peremptory dictates of his vital needs, man tries to foresee them, and is no longer content to live simply from day to day. He foresees his future requirements, and the result is that he *works*. And so we come to a second series of more complicated facts, having man's organized labour as an essential factor.

It should be noted now that such phenomena are of geographical interest to the precise extent that they are represented on the earth's surface by material phenomena: we are not concerned here with the psychological fact of man's foresight; it is not that which should receive our attention, but its material and geographical expression only.

The cultivation of cereals is expressed by a field or a granary, primitive stock-rearing by more or less regular journeys, and the work of the seeker after gold or salt by a 'works.' The farmer's field and granary, the nomad's movements, the gold-digger's workings, and the salt-mine are the new phenomena by which new human facts are represented in the geographical world, and they serve at the same time to distinguish the second set of facts from the first.

From the realm of spontaneous or almost spontaneous phenomena involving only impulsive and often immediate action inspired by vital necessity we have now reached a realm of phenomena controlled by labour looking to a more or less distant future. All these can be grouped under the general heading *exploitation of the earth*—agricultural, pastoral, and industrial geography, corresponding to the second and more complex stage of human geography.

(*C*) Economic and Social Geography

It is still one of the most primary instincts and needs of human beings to perpetuate their species. Actual observation shows us the race ensuring everywhere the transmission of life, and everywhere we notice at least the embryonic beginnings of the family and society. Human beings are nowhere alone, save in quite exceptional circumstances; if individuals are able to live in isolation they cease to belong to geographical humanity. The positive and actual fact is that human beings live everywhere in groups. That is

one of the essential observations that must govern human geography, and it determines yet a third very abundant set of phenomena.

The simplest result of this grouping of human beings at all points on the earth's surface is *exchange*. And this is of particular importance to us because it takes the form of that most significant geographical reality, the market.

But men are not only compelled to divide among themselves the earth's products; they are obliged also to regulate, more or less clearly and consciously, the conditions of production, the division of labour, and, above all, the distribution of the land. As soon as men desire to utilize natural resources and wealth they have to solve, not only technical problems relating to cultivation, mining, and so forth, but such problems also as the co-ordination and subordination of their own efforts. Economic and social regulations are made between them, with varying degrees of rigidity. Thus the system of ownership, whether collective or individual, is a typical example of the numerous social phenomena which, by a more or less direct and successful process of adjustment, are bound up with the actual work of exploiting the earth.

According to the geographical setting in which human groups are placed they tend either to cultivate plants, such as palms in one place, rice in another, and wheat in a third, or to breed horses on the grassy plains of Central Asia, or animals of the bovine species in the mountain areas of Central Europe, on the islands of Lake Chad, or on the shores of Lake Rudolf, or sheep on the dry and lofty table-lands of Iberia and the Berber lands. And these different forms of activity lead to very different kinds of social organization. The idea of ownership, and its limitations, are not the same, as we shall see, for the cultivator who ploughs his furrows in the same field year after year as they are for the herdsman who drives great herds of horses or camels across vast spaces, almost bare of trees, and without any settled population.

All these facts can be gathered together under the term 'social geography,' but it must never be forgotten that, although they are connected with the geographical setting, they are mainly dependent on human will and freedom, so that to analyse them geographically will be a very delicate business, calling for great prudence and circumspection.

(*D*) Political Geography and Geography of History

And now, finally, the coexistence of numerous and varied groups, all needing to feed on the land and to occupy a portion of it, gives rise of necessity to certain relations between them, sometimes peaceful and sometimes violent, some of which are connected with certain general or local facts of a geographical nature. Still more prudence and care are needed in examining this fourth and last set of phenomena of human geography, the 'geography of history'—*i.e.*, political, military, administrative geography, etc. These, as may be imagined, are particularly dependent on human vicissitudes, and certainly are not always possessed of real value from a truly geographical standpoint. Yet there are some fundamental geographical conditions, such as topographical situation, altitude, aspect, nearness to the sea, size of areas occupied or conquered, and so forth, which play so important a part in the destinies of cities, provinces, and states that the history of these things cannot be severed entirely from geographical considerations. More than that, all the roots of human history are buried, as it were, in material terrestrial reality.

But this certainly does not mean that all history can be explained by geography. History unfolds itself on the earth, it is true; but it is made up of elements that are very complex, very mixed, and very far removed from elementary geographical conditions. It is the intermediate facts—the second set, concerned with cultivation, etc., and the

third, the facts of social geography—which chiefly explain the deep impression made by geography on the development of human societies.

By some curious illusion the 'geography of history,' which is the most complicated part of human geography, is also the boldest and most adventurous of geographical enterprises, and the one that has often seemed the easiest.

Anyone taking a glance at a map of the British Isles, and recalling vague memories of the history of England, establishes a connexion so quickly between the insular isolation of these islands and their historical destiny that geography is at once invoked as the cause of that history; and whoever does that would not be wrong. But these primary connecting-links are so obvious and so true that anyone of normal intelligence can see them. There is no need for any hard training in observation to perceive the general influence of English 'insularity' on the policy and destiny of Napoleon. But have we any right to be content with such facile comparisons? Is a true archæologist content to note the general correspondence between a Gothic cathedral and a certain period in the history of Christianity? Can a true botanist be satisfied with seeing some relation between the climate or altitude of a country and the growth of great forests of pines or firs? Is the literary critic content to establish a relation of mere 'contemporaneity' between the works of Boileau, Racine, and La Bruyère? And should the geographer alone declare himself satisfied when he has pointed out some comprehensive connexion, albeit a true one, between the general geographical situation of a country and its general historical destiny?

Moreover, if our analysis ceases to be precise we run the risk of arriving very often at superficial or erroneous conclusions: witness many of the eloquent generalizations of Michelet. If, on the other hand, we choose to go farther many problems arise, and the task is at first sight too difficult to be undertaken. The first result of this more scientific conception of the relations between geography and history is that we must begin at the very beginning, with less ambitious and more modest undertakings. For this reason we shall divide 'human geography' in the most general sense into two distinct parts. One is what we shall call 'initial' or 'fundamental' human geography—the study of facts which can be at once defined and classified under the name of 'essential facts.' That is the sphere of this volume, which we call simply 'human geography.' The other part, which should really be called the 'geography of history,' is the subject on which Camille Vallaux and I, in close collaboration, have planned and written another book, similar to this one—*La Géographie de l'Histoire*.[1]

The task of human geography, then, as of all sciences based on observation, is to proceed by classifying facts, picking out precise categories from the tangled mass in which they are buried, and pursuing the comparative observation of these separate facts by a series of analogous or neighbouring or progressively distinct cases. We must now indicate clearly the principal items of this programme.

3. Attempt at a New and Positive Classification

The Three Groups and Six Types of Essential Facts—Small Natural Units ('Islands' in the Sea, the Desert, the Forest, and the Higher Mountain Regions)

We have just passed in review all the principal forms of human activity on the earth: the geography of the prime necessities of life and of the exploitation of the earth, economic and social geography, political geography, and the geography of history. We can see now for what manifold reasons and in what very general conditions man's actions are

[1] Paris, 1921.

enveloped, combined, and sometimes even hemmed in, by the physical universe. That introduction to human geography is, as it were, its necessary preface. But it is only a preface, and we must beware of regarding an introduction as a methodical and practical plan of investigation and research.

To consider first man's physiological needs, as we have done, is to explain how, from his earliest steps and the first hours of his existence, a human being, whoever he may be, comes inevitably into contact with the physical world. When we bear in mind these necessities, is it not a matter of prime importance to abandon not only every preconceived idea, but also every special fact relating to the human organism? Is there no way of starting all human geography with less acquired knowledge of man and more geography? Is it not our duty to get rid as far as possible of every psychological, ethnological, and sociological idea, and to carry out the primary task of observing human phenomena on the earth, with as little admixture as possible of the subjective human factor?

We shall return later to the grades or stages, which are both logical and sociological, of this complete geography of man, as described in the last paragraph. But that should not be the real point of departure: our geography, which is above all else a science of observation, should start with a more direct vision, a more positive collecting of facts, and a more material classification.

Let us go up some hundreds of yards above the earth in a balloon or an aeroplane, somewhat after the fashion envisaged by the Swiss geologist Suess at the beginning of his great book *Das Antlitz der Erde* [*The Face of the Earth*]. Then, ridding our mind of all knowledge of man, let us try to see and note the essential facts of human geography with the same eyes and in the same way as we discover and disentangle the morphological, topographical, and hydrographic features of the earth's surface. From this imaginary vantage-point what shall we see? Or, better still, what are the human facts that a photographic plate would register just as well as the retina of the eye?

First of all, there would be the men themselves, forming a mobile covering of the surface, differing greatly in density at different points. Moreover, this mobility is more restricted, and this inequality of distribution more constant and persistent, than might at first be imagined. Each individual and each little group considered separately can, indeed, and does, change its place, but it is equally true that on a map of the world the great patches of living humanity appear for a long time in the same places: the general distribution of the larger human masses seems subject to a certain fixity, relative, to be sure, but none the less amazing. We are not trying yet to explain the fact: we see it and take note of it. The Siberian tundra, the *hamadas* of the Sahara, and the forests of the Amazon remain almost entirely empty of human beings, whereas population accumulates and crowds in the damp and muddy deltas of the Far East and in certain areas of Western and Central Europe.

Wherever there are men we find also other surface phenomena of a concrete kind, and the more numerous the men the more numerous are these phenomena. They can be reduced to six essential types, as follows:

(A) Those connected with the Unproductive Occupation of the Soil

(i) and (ii) Houses and Highways

First comes one of the most obvious—a kind of superficial excrescence—the house, shelter, habitation, or human construction. Under the general term 'house' we include

all those innumerable and varied objects strewn over the earth's crust like thousands of tiny spots—red-tiled, grey-slated, white marble or whitewashed, the brownish black of old thatch or the yellow-brown of dried leaves, close together or scattered, large and small, and of varying durability. They range from the humblest straw hut of the savage to the most elaborate public buildings in the cities, observatory domes, and cathedral spires, and from the lonely huts or cabins of the arid steppes to the compact masses of adjoining dwellings in almost unbroken lines in the largest and densest aggregations of human beings.

These are accompanied almost always and almost everywhere by a second feature, the road or highway, devoted—one might almost say 'sacrificed'—to movement or circulation. It includes the scarcely beaten track that leads to the chalet or the shepherd's hut of the mountains, the great paved or asphalted streets of our cities, the white roads that climb with skilfully engineered bends up the sides of the Alps, the Cevennes, or the Lebanon, the iron roads that score the land with their parallel rails, and the 'moving' highways—waterways, embanked rivers, and canals. To the highway in this sense are attached all the accessories and excrescences, material and concrete, that are the marks and signs of circulation and human communications, such as bridges and tunnels, squares and ports—all those things that make up 'the road.' We notice at the first glance the close geographical connexion between the house and the highway (see Figs. 1, 64, 65, 66, and 67), and how they are still more closely intermingled when human establishments are in a concentrated form. The town, geographically speaking, both in appearance and reality, has as much emptiness as fullness, so to speak—streets, crossroads, and squares, as well as dwellings and public buildings. (See Fig. 2.)

Houses and highways, then, are in close connexion with each other on the inhabited earth, and are the two essential human things which can legitimately be said to occupy the soil unproductively, in a strictly literal sense, and with no depreciatory significance at all.

(*B*) Things connected with the Conquest of the Plant and Animal Worlds

(iii) and (iv) Cultivated Fields and Domesticated Animals

There are still other patches appearing on the earth's surface, and the denser the population the more numerous they are. These patches have fairly regular and definite outlines, and their colours vary with the seasons, being sometimes the dull hue of bare earth or the warm, rich colour of newly dug soil, sometimes the soft green of young plants, the dark yellow of ripe grain, or the vivid white of the cherry-blossom or the cotton-fibre. They are those parts of the surface where the soil is scratched or turned over or altered in some way, and the general term for them, which expresses what we actually see, is 'fields' or 'gardens.' They are, indeed, the geographical and material expression of 'cultivation'—the subordination of the plant world to the human will. The corn-fields of the table-lands of Beauce or the 'black earth' of Russia; the terraced hillsides of the Mediterranean countries, planted with lofty vines or ancient olive-trees, twisted and always leafy; the lines of crowded beds in the market-gardens of the Paris suburbs; the draughtboard pattern of the muddy rice-fields of China or Java; the pale eucalyptus woods in the 'oases' of the Roman Campagna; or the old palm-groves of the Sahara, giving shelter beneath their slender leaves to fig-trees and pomegranates, barley and beans—all these fields or gardens are to such an extent the actual impressions of human

toil that they would be recorded on photographic plates even if we did not know by what skilful and patient effort the natural plant covering of the earth has been thus changed, over such vast areas and in such a variety of ways. (See Figs. 7, 8, 61–67, 70, and 89.)

There is a fourth phenomenon that occurs sometimes in association with the 'field' or 'garden,' and sometimes—often even to an important extent and in a highly developed form—where the cultivated patches are few and far between. In both cases, however, they are dependent always on the presence of man. Camels and dromedaries scattered about where they can feed on the tufts of hard and coarse herbage of the desert; herds of cows grazing on the short, sweet-scented grass of the Alps; long columns of sheep, close-packed together, browsing on leaves and stalks on the arid Mediterranean steppes; Arab horses guided separately by human hands; reindeer pulling sledges over the snows of Lapland; Egyptian buffaloes drawing ploughs and goaded by men to trace furrows in the fields—all these go to make up an animal population plainly subjected to the will of man, and described by the two general and concrete terms the *herd* and the *beast of burden.* (See Figs. 94 and 95.)

It is through these actual forms—fields and gardens, herds and beasts of burden—that we should first introduce into the study of geography such many different things as 'cultivated plants' and 'domesticated animals.' Some of them are of great and traditional antiquity, others new and unexpected novelties, but ever since the beginnings of human prehistory they have included all that is covered by the phrase 'the conquest of the plant and animal worlds.'

(*C*) The Destructive Economy

(v) and (vi) Mineral Exploitation and Destruction of Plants and Animals

It remains to notice from our point of vantage two other kinds of phenomena, both representing, though in different degrees, as we shall see, the 'destructive economy,' or, in the forcible German phrase, 'robber economy' (*Raubwirtschaft*).

Here and there on the earth, often near to houses, the soil has been pierced, and gaping holes mark the spots where men have removed the stone for their own use, without making any restitution. Sand-pits, tufa-quarries, sulphur-mines, quarries of marble or granite, rock-salt deposits—all these things, large and small, can be grouped under the term 'quarry.' And, geographically speaking, we pass by insensible degrees from the quarry to the mine—that is to say, from the piercing of the earth's surface to the excavation of its depths. Thus in the Commentry basin and in Pennsylvania, as in the 'open' mines of Hatou and Campha, in the rich coal-bearing basin of Northern Tonkin, the 'mines' are open to the sky, whereas in Westphalia and Pas-de-Calais they are hundreds of yards below the surface. In both cases the 'hole' is made by man, to extract and take away, once and for all, such mineral substances as silver, diamonds, coal, salt, or gypsum, and the 'hole' in the earth is the actual sign of the 'destructive economy.' (See Figs. 96 and 97.)

The quarry and the mine, which exhaust the wealth of the earth without replenishing it, are found in particular as geographical companions and neighbours of the two things that mark the 'unproductive occupation of the soil'—*i.e.*, houses and roads. But the sixth and last kind of surface phenomenon, also a destructive one, belongs rather to the sphere of 'plant and animal conquest,' with which it is frequently intermingled. It includes actions that are often brutal and violent, almost always rapid and ephemeral, and always definite and decisive. In the vegetable realm it takes the material form of wild fruits

plucked and eaten, trees cut down, and forests burned (see Figs. 99–101), and in the animal world of wild beasts hunted and killed and fish caught. Destruction and pillage by the Tuareg nomads in the cultivated oases, and the unreasonable and senseless exploitation of rubber-trees in the Congo or the Amazon region, are on the same footing as the excessive hunting that leads to the extermination of such kinds of creatures as birds of beautiful plumage, fur-bearing animals, and those that yield ivory. Now, a little reflection will show that, though the simple destruction of plants and hunting and fishing do not always involve such serious and widespread consequences or call for such severe condemnation, and can sometimes even be associated with a wise economy, yet they all tend to remove from the earth living things in whose reproduction man has in no way co-operated, and they are all, in principle, a form of murder. (See Fig. 98.) All these things, too, are actual and visible, and if ordinary photographic methods cannot, as in other cases, capture and depict these momentary acts, the cinematograph at least can record them without difficulty.

The 'Islands' or 'Islets' of the Inhabited Earth

Only later on shall we be able and obliged to consider the general repercussions of these phenomena upon each other, and not to neglect that 'geography of the whole' which is in truth the highest as well as the ultimate end of geography. Yet it must certainly not be imagined that it is easy to discover at first glance what is really and truly geographical in the manifestations of human life in such vast and dissimilar surroundings as those which make up a complex whole like France or the United States. But a detailed and easier study of smaller units will make it possible and necessary to begin to define the strictly geographical relations between natural phenomena and the destiny of men. And among those places on our inhabited planet that are sufficiently isolated to constitute separate, and therefore simpler, units there are four types of geographical microcosms—four kinds of islands or islets of humanity—which seem marked out for our observation. These are:

(i) Islands in the sea.
(ii) Oases, which are human islands in the desert.
(iii) Human islands or inhabited oases in the great northern and equatorial forests.
(iv) Lastly, the high, closed valleys in mountain regions, which are like human islands or isolated oases in the mountains.

Chapters III, IV, and V will show the method of collecting material for this human geography based on the classification of the three groups of essential facts. In Chapters VI, VII, and VIII (§1) will be found special studies of various kinds of islands.

4. Natural Forces

Water and Wind—Human Beings—Primary Maps (Rainfall and Population)

Among those natural phenomena and forces with which man is linked geographically almost as closely as with air, water deserves a place in the first rank. Water is pre-eminently the supreme economic wealth—even more so for man than coal or gold.

There is no house or human habitation in the building of which man has not had to take into account the proximity of water. The smallest chalet in the mountains is situated primarily near a streamlet or a spring, and a village has of necessity its spring or well. In countries where the climatic

conditions include a longer or shorter dry period, the roofs and terraces are so constructed as to collect all the rainwater in tanks. (See Figs. 3 and 4.)

One of the greatest problems of large urban concentrations is that of water-supply. It is a problem of public health and social life of capital importance, and requires to be examined as a whole from a particularly geographical point of view. Thus from its simplest to its most extensive form the human dwelling must be always closely connected with a certain quantity of water.

Roads and streets also are surface facts which cannot do without water. The great highways traversed by nomadic tribes are dependent on the distribution of watering-places; trains have to stop for water at fixed places; and motor-cars need to find water on the road.

The phenomena of destructive economy are somewhat less dependent on water than the two kinds of unproductive occupation just considered, but here also it would be easy to show, from the connexion between water on the one hand and the plant and animal worlds on the other, that there are actually bonds between these less methodical forms of human activity and the distribution of water. There is no need to mention fishing, but even the extractive industries of quarrying and mining require great quantities of water, either for the work itself or for the needs of the men engaged in it; the vast hydraulic works needed for the extraction of gold in Western Australia, for instance, are well known.

But if we proceed from the facts relating to unproductive occupation and destructive economy to those concerned with the conquest of the plant and animal worlds, we find that these latter are still more completely dependent on the meteorological and geological conditions which govern and explain the distribution of water.

Now, the greater the stillness of the air and the clearness of the sky the greater is the amount of evaporation. It is in climates where there is least rain that water will be most necessary for cultivation, and this fact shows the extent to which artificial watering, or *irrigation*, is the principal method of plant conquest in all arid, semi-arid, and desert lands. Moreover, it is in connexion with the garden or the irrigated field that the true relations between man and water can in these circumstances be perceived; and it is that one of the six essential facts of geographical reality that should be in the forefront of our observation, and that serves, as it were, as an introduction to the examination of the more general problem.

In connexion also with the painstaking and conscientious cultivation of the fields we shall meet with what is called 'dry farming.' To prepare the ground by repeated hoeing, and to make use of the smallest drops of water that fall on it by storing them up to prevent them running off the surface or evaporating—this is indeed a direct tribute to the omnipotence of water. Dry farming shows more than anything else the supreme value of water. (See Figs. 5, 7, and 8.)

Water, then, is an ingredient of the whole of human life, and, if Ratzel could write at the beginning of his *Politische Geographie* that "every State is a portion of soil and of humanity," we can supplement his words by adding, "Every State, and, indeed, every human establishment, is an amalgam made up of a little humanity, a little soil, and a little water." That is why the whole of hydrography, both continental and marine, has from the very beginning exercised so great an influence on mankind, and why geographers in every age have directed their attention to these things. There is, for instance, Metchnikoff's book, *Civilization and the Great Historic Rivers*, for which Élisée Reclus wrote a preface. Rivers, however, have been regarded too much as uniform geographical features, uniformly

useful to human requirements. There are rivers which discourage human labour as well as those which attract it, and even the latter have needed the long-continued labour of men to make them really 'human instruments.' The navigable stream is a fact of human geography to a far greater extent than has often been noticed.

Many writers—both geographers and others—have stressed the importance of the part played by the sea in human affairs. One geographer, Camille Vallaux, devoted a volume of 'social' geography to the subject of the sea, directly inspired by Ratzel's ideas. Men are attracted by the sea because it is at the same time a highway and a fishing-ground. Rivers, too, are both roads and fisheries. When the tide floods the estuaries and ascends the rivers of the British Isles it increases enormously both the line of contact between sea and land and the volume of traffic that may result. The tide that makes it possible for great ships to enter and leave the ports is like a drawbridge thrown across a moat to restore the continuity of an approach-road. And as a purveyor of food, despite the efforts of a few political groups to restrict it, the sea is the most extensive of all forms of collective wealth: it remains the largest 'common' in the world.

Looking at these global facts in their truly geographical aspect, we shall find them belonging to one or other of the six essential types of phenomena. And, consciously or unconsciously, whether he likes it or not, every author who tries to give precision to this discussion arrives necessarily, and more or less clearly, at this primary analysis, as a page from Camille Vallaux will show:

> "Boysen remarked that the English Channel, owing to the traffic that it carries, has a permanent population as dense as that of the province of Yakutsk. Is it not, then, like Yakutsk, an 'œcumeny,' or inhabited world, which geographers must study? This remark of Boysen's is interesting, but taken literally it would lead to some confusion that we should do our best to avoid. No doubt if we regard the Channel as a continental shelf (as it actually is, for its depth is nowhere more than fifty fathoms, except in the narrow Alderney Deep), and if, therefore, we look upon it as a fishery zone, then it is an 'œcumeny,' though less populous than such similar zones as the Dogger Bank and the Vendée coast in Brittany. If we regard it as a region of constant and uninterrupted crossings between France and England it is still an 'œcumeny.' But, however interesting these two characteristics of the Channel may be, it is not primarily to them that it owes the large population that ploughs its waters and that Boysen had in mind. This it owes above all to its being a highway between North-west Europe and the Atlantic, and in this most important respect it is *not* an 'œcumeny,' for the travellers on the liners and tramps sail this sea without remaining on it, and in most cases without staying on its shores. To this mobile travelling population the Channel gives no geographical framework: it serves merely as a connecting-link between many such fixed frameworks, from which those who traverse it are detached, either singly or in groups."[1]

There is still another thing that water does for man, for, in obedience to the laws of gravity as it pours down from the mountains to the sea, it is a force, and may become a source of energy. This force, made use of in various ingenious ways, has for centuries driven mill-wheels, irrigation wheels, vertical saws, and so forth. (See Figs. 9–11.) Then, later, came the period which saw the almost limitless increase and improvement of the ways of utilizing 'white coal,' 'green coal,' and even 'blue coal.'

White Coal

During the last fifty years the development of hydro-electric factories and the transmission of electrical power has not only paved the way for a great industrial revolution,

[1] C. Vallaux, *La Mer*, pp. 8–9.

but has actually brought it about already, thus giving to countries without coal, like Switzerland and Italy, a measure of economic power and a status hitherto impossible to imagine or foresee. These countries have laboured ever since to free themselves, at least in part, from the economic subjection that 'black coal' imposed upon them.

The birthplace of white coal—the hydro-electric use of flowing or falling water—was Dauphiné, and its forerunner was the famous paper-maker Aristide Bergès, who, more than fifty years ago, fitted up a 650-foot fall of water at Lancey. The technical solution of the problem—what might be called the Alpine solution—was relatively simple, for the Alps have been deeply hollowed out, and by being diverted the streams have easily been made to 'take the leap' at suitable places for the installation of pipelines and factories. It is a fundamental geographical fact that the Alps are very accessible by way of wide valleys, so that the factories can be set up in the heart of the mountains, thus reducing the cost very appreciably and making the profit considerable.

The Pyrenees, though lower and more massive than the Alps, yet provide favourable conditions also, though of a different kind—namely, steep slopes, and valleys whose longitudinal section is irregular and steep. On the French side, however, from the mountain-tops to the plain, the Pyrenees are of no great extent or width, the mountain streams are short, and the amount of water collected in the upper regions is only moderate. They have no water-course comparable to the Isère, the Drac, or the Durance, and no wide valley like that splendid Alpine avenue of settlements, Grésivaudan. The Pyrenean method, therefore, has adapted itself to these special orographical and hydrographical conditions, with the aid of intakes of water at higher altitudes and much longer and more costly diversions.

Of late years the chief proposal has been to harness lakes situated very high up in the mountains—between 6000 and 8000 feet—for these are veritable water-towers, magnificent natural reserves of energy, available at all seasons.

But the progress that has been made by solutions adapted to differing geographical environments is not confined to these environments, for as soon as the standard methods have reached real technical perfection they 'emigrate'—if the word is permissible—and go to supplement the equipment of other regions. In the French Central Massif the first idea was to adopt what is called the Alpine method of harnessing hydraulic power, but it became apparent that it was not reasonable to try to treat mountains of a different kind in the way that the Alps had been treated. A new technique had to be started, which should be called the Central Massif method. It was possible to correct the lack of slope and the irregularity of the flow of water by building *barrage reservoirs*—enormous constructions, blocking entire valleys, and thus succeeding, with great trouble and at great cost, in storing up millions of cubic feet of water. Then the engineers, fortified by the experience gained in regions calling for superior technique and improved workmanship, 'imported' the new procedure into the Alps. To those Alpine areas where white coal was born the new methods, tested elsewhere, returned as conquerors. They are more troublesome, but they give greater security against dangerously capricious behaviour on the part of the forces of Nature. The use of barrage dams and reservoirs very high up in the mountains thus tends to overcome the irregularity of flow of the Alpine streams, and thereby to regularize production. And so ideas return, enriched and fertilized, to the very places where they were born.

In this same region of Dauphiné there has taken place of recent years, thanks to white coal, a measure of industrial and social development whose consequences may be of importance to the whole life of the nation. Industrial establishments have multiplied, and are scattered over areas hitherto purely agricultural or pastoral.

Coal—or, rather, the latent energy that it symbolizes—has taken on one colour after another in recent years. After black coal there appeared the white fairy of Dauphiné—glaciers and Alpine streams—now familiar to the whole world. After white coal came the 'green coal' of the rivers, and now the 'blue coal' of the sea and the tides is on the way: an annual total of one million horsepower obtained from the sea would mean a national saving of at least ten million metric tons of coal.

It is by human beings that this utilization of hydro-electric power is directed, and this new phenomenon—the taming of natural forces—is revealed and characterized by human settlement, the construction of factories, and the creation of a transmission network—that is to say, once more, by some of the essential features described in an earlier paragraph—namely, houses and highways.

* There has been indeed a taming of the forces of Nature. By means of a network that links together the hydraulic generating-stations and the steam generating-stations France has available right through the year, even in periods of drought, enough electricity to meet all its requirements. This powerful network ensures the regular distribution of electricity throughout the country (see Map III), and this collaboration of the various energy-producing centres (for the steam generating-stations fill the gaps in the hydraulic ones) has made it possible to mitigate the inconveniences arising from irregular supply, itself due to variations in the flow of water and differences in the systems of the hydraulic reservoirs (see Diagram IV). The transmission of electricity, too, has corrected the unequal distribution of the sources of energy in France, thereby enabling the consumer factories to make a more independent choice of site, according to the situation of the mine, the steam generating-station, and the hydro-electric system.

The development cf traffic and transport in all their forms tends, therefore, to produce an increasingly topographical separation between the regions of production, transformation, and consumption.

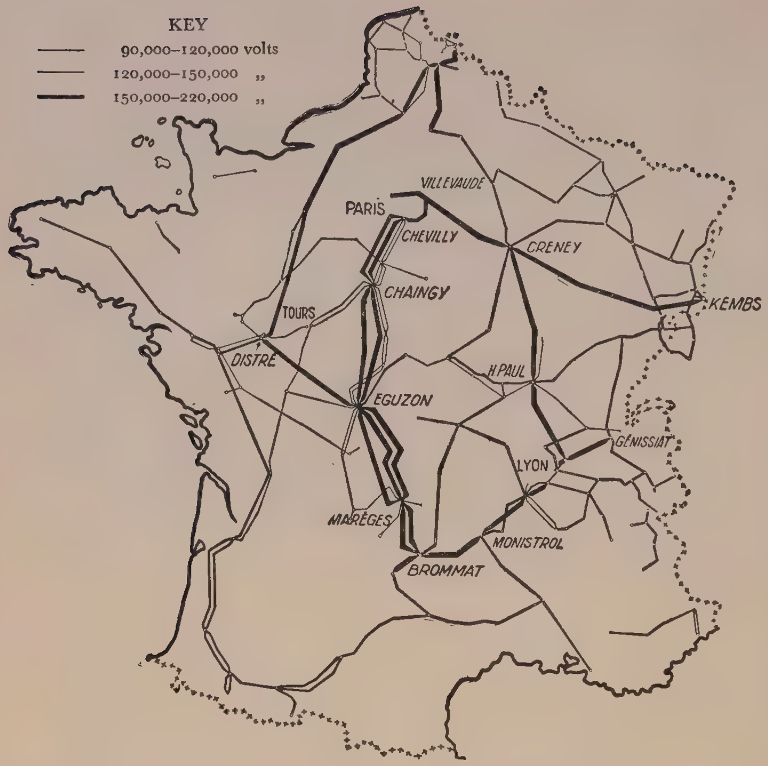
In spite of this domination and this independence, however, the original geographical imprint remains deeply impressed. It is shown in the very organization of the circulation of energy in relation to production and consumption. In England the question of the distribution of electricity does not arise as it does in France, because in England coal is abundant and comparatively scattered; there is no hydro-electric current and virtually only steam generating-stations; and the supply circuits differ from each other, each forming a complete and self-sufficient unit. In these circumstances there is no need for current to circulate from one circuit to another. So the English network, in contrast to the French, is naturally split up, and works in several separate 'packets.'

The geographical imprint is shown also in the transmission of energy itself. Indeed, if we study the movement to and fro of the masses of energy transmitted we shall see that they reveal the seasonal character of the production of water-power. At its 'peak' periods the excess of electricity flows towards the region of Paris, where it is absorbed. (See Diagram IV, and note the parallel character of the top curves.) In periods of drought, on the other hand, the hydro-electric generating-stations produce too little, and the Paris district can then not only meet its own needs by having recourse to the steam generating-stations, but also send power back to the hydro-electric stations.*

It is obviously to man's interest to make more and more use of force that is provided free, and this is actually being done to an increasing extent. This development has been carefully observed in a compilation entitled *L'Homme et la terre cultivée* [*Man and the Cultivated Earth*].

Air in movement is also a force, like water in movement, and this second natural force, the wind, is far from negligible. (See Fig. 12.) It was a valuable auxiliary in days when man was less spoilt than he is to-day, and had far weaker sources of energy at his disposal. He had nothing but the wind to help him sail his ships. Nowadays the wind is still used for mills and fishing-boats, though the big sailing-ships have disappeared. The wind, to be sure, is a capricious and irregular force, but it is free, and it is inexhaustible, and at sea as well as on land it is still not altogether despised. (See Figs. 13 and 14.)

Finally, amid all these things revealed by a general glance over the earth's surface there appears also, and in the very front rank, that irregular covering that consists of



Map III

The Network of Main Electrical Transmission Lines in France in 1939

Map III. The network of main lines for the transmission of electrical power establishes a close connexion between the steam generating-stations and the hydraulic ones. It will be seen to what an extent the harnessing of natural forces is accomplished by a complete network for production and transmission. The production of hydraulic power in 1939 was 12 million kwh., and of steam-generated power 8½ million kwh. The length of circuits (exceeding 90,000 volts) was 10,000 miles in 1945, as compared with 700 miles in 1923.*

Diagram IV. In order to make the best and most economical use of the hydro-electric production of the Alps and the Central Massif, the methods of distribution and consumption have been adapted to the seasonal variations in production in these two areas. In the Alps production is at a maximum in the summer, when the glaciers melt, and reaches its lowest point in winter. In the Central Massif, an area of rushing water, the minimum production is in the summer. The Paris district has been equipped so as to absorb the 'peaks' of production: note the similarity between the curves of total hydro-electric production and the amount consumed in the great Paris conurbation. The periods of excess hydro-electric production correspond to the periods when the steam-generating stations are less active, while the latter intensify their activity during the 'gaps' in hydro-electric production.*

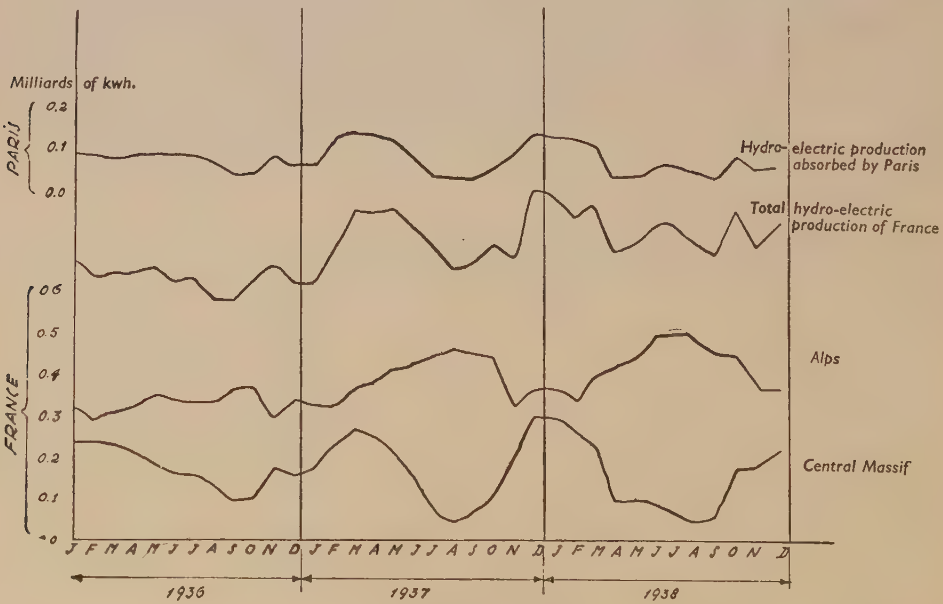


Diagram IV

Seasonal Variation in Hydro-electric Production in France in the Years 1936, 1937, and 1938

the human population itself. Men too must be regarded as a kind of natural force, present in some places and rare in others, and as a sort of basic fact which human power can use, though it can scarcely change it at all quickly or radically. The phenomena of life have not arisen only from geographical causes, nor are they bound closely and inevitably to such causes alone. To imagine otherwise would be a great mistake. Moreover, the study of the earth's population belongs to the 'geography of history,' and in *La Géographie de l'Histoire* two long chapters are devoted to it. Geographers could not but be interested in the distant beginnings of the present population and the obscure and complicated considerations determining its distribution. But they are required above all to search for present influences, and these do not all belong to the realm of geography. No one would dare to assert that the 'natural setting' provides the key to all those fascinating and complicated demographic phenomena called birth, marriage, death, and so forth. What, then, has human geography to do with these things? Where, in what forms, and in what ways should demography benefit from geographical observations, and how should its own results be of benefit to geography?

It is made clear by all the evidence that geographers have been enabled by censuses and the accompanying critical analyses to understand the main facts about population. The countries which have regular and methodical censuses are those in which the geographer finds material for definite conclusions, and Vidal de la Blache has laid the proper stress on the importance of population facts.

But these population phenomena are shown to us, are even ascertained and measured at a census, only through the medium of human habitation. By the very fact of some physical establishment on a fixed spot of land men are 'captured' and counted, and where they are not so fixed they escape all control and all precise numbering. Now, the earth's covering of human dwellings is a more geographical phenomenon, more closely connected with natural conditions, than the human covering itself. The first is the visible sign of the second, and it is also of such a kind that it is pre-eminently the province of the geographer. True geographical demography is above all the demography of human habitation. The two phenomena, also, of unproductive occupation—namely, houses and highways—are arranged in different systems that are actually representative outlines of the progress of human settlement.

The human element as a force applied to the transformation of the earth's surface will appear as a factor that explains and collaborates with each of the visible and tangible results of this transformation. In connexion with the cultivated field and the mine, men will have to be studied to the extent that they determine these things, and to the extent that they remain connected with them. We shall see how the labour factor enters into every study of cultivation, of destruction, and of mineral exploitation. Nowhere does man stand idle; everywhere he eats and sleeps, if he does nothing else; everywhere he leaves his mark, and this mark is the prime object of our study. (See Map VI, p. 57.)

Proceeding by way of analysis, and following our principle of classification, we have to discover, step by step, the problems of human settlement. In connexion with the house, the village, and the town we must examine, in its actual and logical aspect, the question of the distribution of population, as well as the maps that aim at depicting this distribution. In connexion with the facts of cultivation, of destructive economy, and of 'islands' in the desert and the mountains, dealt with in the following chapters, always and everywhere the peculiarities of human settlement will be noted in their proper places.

The Two Primary Maps of All Human Geography

If it is our desire to draw a conclusion from this critical examination of the natural forces which are the primary factors in human geography we must offer as the fundamental and primary maps in all such geography the *map of water* and the *map of men*—*i.e.*, in a simple and universal form, the map of the general distribution of rainfall and that of the general distribution of population.

Not all man's supply of water, for his existence or his work, comes from rainfall alone, a fact that is better known to those engaged in irrigation work in dry countries than to anyone else. But the expenditure of time, money, and muscular effort required for artificial watering makes it clear, by contrast, how great is the geographical and economic boon of the atmospheric water poured in drops over such vast areas. Almost all the water that we use—spring-water, well-water, river-water, etc.—is connected, directly or indirectly, with rain. Excessive rainfall, too, like a shortage of rain, militates against an excessive growth of population, so that the greatest and best development of humanity is found in the areas lying between these two extremes. It is always the intermediate zones that are the great cradles of population, and we shall certainly have to return to this very important point when we treat of those kinds of work that are most directly related to climate, such as the conquest of the plant and animal worlds (see Chapter IV, § 1). But it is no less true that a general rainfall map depicts one of those phenomena whose actual distribution governs the geography of man to the highest degree.

The distribution of the human race is another geographical fact of capital importance. To study human groups from the ethnic, historical, and geographical points of view should be a later task—that of the geography of history. It is quite certain that racial and political facts count for much among the causes that explain the present distribution of population, and to make that distribution depend on geography alone would be a mistake. The two Americas, invaded to-day by migrations from the Old World, and so favourable in many parts to human settlement, have for a very long time been in places a collection of 'anœcumenies.' A hundred years ago they were empty compared with other parts of the world, such as Europe, Asia, and even Africa, and even to-day a comparative table showing the actual area and population as well as the relative area and population of the great land units justifies the assertion that human life is localized and distributed over the earth in a way that is far from dependent on natural conditions.

The continent of Asia, which is not much larger than the two Americas, has a population four times as large as that of the New World, and actually two-thirds of the human race live on an area no greater than one-seventh of the total land-area of the earth.

Total Population and Area of the Earth[1]

Total Population of the World in Millions	Area in Millions of Square Miles			Average Population per Square Mile of Land
	World	Land	Water	
2115	196	55	141	38.5

[1] Figures for 1939.

AREA AND POPULATION OF THE EARTH ACCORDING TO CONTINENTS[1]

CONTINENT	POPULATION IN MILLIONS	AREA IN MILLIONS OF SQUARE MILES	AVERAGE POPULATION PER SQUARE MILE	PERCENTAGE OF WORLD POPULATION
America	268	16·2	16·5	12·7
Asia (including Asiatic Russia)	1153	16·6	69·5	54·5
Europe (including European Russia)	533	4·4	121·0	25·2
Africa	151	11·5	13·0	7·1
Australia and Oceania	10	3·3	3·0	0·5
TOTALS	2115	52·0	—	100·0

A critical examination in detail of regions having close natural resemblances to each other would be even more revealing.

First by its latitude, and secondly by its climate and productions, although the distribution of the latter is different, and although the Southern Mediterranean zone of Europe is equivalent to the western zone of the Pacific, Canada as a whole can bear comparison with Europe. Canada has an area of 4,055,000 square miles, while that of Europe is 4,394,000 square miles, which we can regard as roughly equal. But whereas Europe is able to contain and feed and keep alive 533 million people, Canada has only 11 million, so that the average density of the population of Europe is 121 persons to the square mile, while that of Canada is scarcely more than 2½.[1]

We shall be right, then, in repeating in Chapter VIII that *primary and fundamental human geography*, or *human geography* in the proper sense, should be first *the geography of the material achievements of man*, thus preparing the way for *the geography of groups and races of men*, particularly as these groups and races translate their specific and different forms of activity into material achievements, or reveal their existence and their presence by these achievements themselves.

There are, indeed, actual relations between the general rainfall map and the general population map, so we have wished not only to compare them, but to facilitate comparison by superimposing one upon the other. Furthermore, our study of the vegetation zones in connexion with climatic zones, preparatory to an examination of some forms of cultivation, will still further define these relations. But these two groups of facts—rainfall and human settlement—will be considered here as the fundamental, primary, and almost brutal factors in the infinitely varied play of cause and effect which has resulted in clothing the earth's surface with a multitude of human traces and imprints. From these various observed facts it is evident that all the phenomena of primary and fundamental human geography—to which we shall give the simple and recognized name 'human geography' —can and should be examined in the light of what are called 'essential' facts. These we shall now analyse in greater detail, with the help of numerous examples.

[1] Figures for 1939.

Chapter III

ESSENTIAL FACTS OF HUMAN GEOGRAPHY

FIRST GROUP: UNPRODUCTIVE OCCUPATION OF THE SOIL—HOUSES AND HIGHWAYS

THAT minor geographical phenomenon that is closely bound up with our everyday life—the human dwelling—is almost as short-lived as we are ourselves. In the best-preserved cities the oldest houses date only from some three or four centuries back, and, generally speaking, the ordinary house disappears and is rebuilt with very great rapidity. If such a rapidly changing thing yet retains some permanent features, and a kind of general appearance which is transmissible, it is undoubtedly due to a powerful tradition that influences succeeding forms; but it is also because the human dwelling depends, to an extent that we have to determine, and which is also variable, on natural conditions. It is especially houses in the country and isolated houses, the houses of ordinary men, that bear and show the marks of this dependence on geographical environment. What chiefly interests the geographer is the predominant feature, which is merely the most representative type in a given region. Anything exceptional has less value for the student of human geography than anything typical.

1. Kinds of Houses

(1) *The Wooden House of the Northern and Central European Forest Regions;* (2) *The Egyptian House* (*Earthen and Stone Houses*)

Many investigators, scholars and artists, archæologists, ethnologists, and architects, have assiduously noted the various forms of town and country houses. The form of the house interests the geographer, not for its details, but as a whole—for its general plan and the way it is adapted to geographical conditions. Even where human initiative seems to be freed from too rigid a domination by environment, through the complications of long historical influences and the increase in human power that results from a very advanced civilization, there is much for geographical observation not only to glean but to harvest.

There are many dwellings whose dependence on their geographical setting is striking. Such are the *igloos*, or snow huts of the American Eskimo; the summer *tchoum* and the winter *yourt* of the Ostiaks; the grey felt tents of the nomads of Central Asia; the cabins of the Tahitians, or those of the Congolese, made of leaves and stalks; the round, thatched huts of Harar, at the foot of the Abyssinian massif; the unwalled houses with roofs of leaves of Eastern Bolivia; the dwellings of the fishermen of Brazil (see Fig. 24); and so forth.

The impression left by these studies, as by so many others, is that despite the ethnic principles of imitation and repetition there are variations appearing everywhere that are connected with geography. It was believed at one time that in the whole of the Sudan there was but one predominant kind of dwelling—the round hut with a conical roof—but recent explorations have revealed a multiplicity of forms, all adapted to their environment. There used to be a tendency also to regard certain types of dwellings as belonging

to a certain period of history, and even in some cases to an epoch in the progress of the human race.

The age of *palafittes*—villages built on piles beside the water—is not ended. It began a very long time ago in certain favoured spots, such as the shores of the Swiss lakes in Neolithic times, and the tradition of pile-built houses remained there right up to the eve of modern times. But even to-day there are many races which build on piles. (See Figs. 15–17.) Neither are the cave-dwellers, or troglodytes, prehistoric communities alone. Men have dwelt, and still dwell, in grottoes where soft, homogeneous, and non-porous rocks, like the Turonian chalk, the Swiss molasse, or the Chinese loess, enable them to make an adequate shelter for themselves at little cost. Even without going so far as Africa or America, we can examine their dwellings as a type of human geography in France, Switzerland, and Italy, where it was reckoned before the War by the Central Bureau of Statistics that more than 200,000 persons inhabited upward of 37,000 underground dwellings. (See Figs. 18–20.)

If we traverse from north to south the vast plains of European Russia, where the succession of natural zones is clearly apparent in a manner that is absent from the much divided Western Europe, we are struck by the regular succession of the ordinary kinds of dwellings. In the northern tundra zone, where the subsoil is frozen and there is no flora except a scanty one of cryptogams, the only human dwellings are huts. Next comes the great northern forest, where we meet with wooden houses. Then southward stretch the grassy steppes, with their rich 'black earth,' and here the houses are built of earth or mud, and covered with thatch or turf. This region without trees or stones is followed by the stony steppe of the Crimea and the Caucasus mountain chain, where the stone house reappears, while on the southern slope of the Western and Central Caucasus the warm, damp climate is shown by the trees and shrubs with flexible stems, which are themselves reflected in ancillary buildings such as barns, usually of wattles.

Wooden Houses in the Forest Regions of Europe

The wooden house that is widespread in Finland and Russia belongs, as we have said, to the great northern forest, which once stretched almost without a break over the whole of Central Europe. But the intensive clearing process that accompanies historical development has split it up. Settlement has taken place, and could take place, only at the expense of the forest, and in many places, even in the immediate neighbourhood of large cities like Munich, human settlements appear as clearings among the trees. (See Map V.) Mighty islands of primitive forest still remain in the mountain massifs of the Hercynian and Alpine zones—the Harz, Black Forest, Vosges, Jura, Alps, etc. And wherever the forest still covers extensive areas there appear the wooden houses, whether in Sweden or Bohemia, in the French Alps or the Swiss Alps. (See Figs. 21–24, 108, and 109.)

The northern forest consists mainly of very straight-trunked trees, such as the Norwegian pine, the spruce fir, and the beech, and there are vast areas covered by each of these species. The method of house-building reflects these characteristics of the forest. The straight trunks of these trees can be easily placed one upon another or sawn into planks, and the houses, in their simplest form, are built of superimposed planks, sometimes rough and sometimes more or less regularly squared. These planks meet at the four corners, and there are the four walls ready built. In Finland the walls of the houses are almost exactly the same as those of the cottages of Valais, the houses in the small Czech villages, and the huts of the Swedish foresters. And we find the same system of superimposed planks, joined at the corners, in the Siberian *taïga* and the Canadian forests.

Map V

Human Settlements in the Central European Forest

This area to the south and south-east of Munich shows, merely by a map, the way in which human settlements have been made in the form of clearings in the great forest, and if the meadows near the forest were added the regularly circular shape of these clearings would be even more striking. These facts, still so obvious on the modern map, are confirmed by history. Here are the dates of the first mention of the chief settlements—Hohenbrunn in 812, Siegertsbrunn in 1075, Putzbrunn in 1095, Brunthal in 1073, Grasbrunn in 1160. It is not surprising that the first three were founded by the Benedictine convent at Tegernsee, for the monastic settlers were the first to open up the vast German forests.

From the 1 : 100,000 *map issued by the Topographical Bureau of the Bavarian General Staff*

The problem of covering the house is delicate and difficult in all climates, though relatively easy in the northern forests, where the fine, straight trunks provide the essential material for the carpenter. The roof itself is made, therefore, according to circumstances, of wooden tiles or shingles, of thatch, or even of flat stones, like the great slabs of schist with which the peasants of Valais cover their cottages. (See Figs. 32–35.)

The shape of the roof, too, will depend in varying degrees on climatic conditions. Throughout the Alps the ridge-roofs of the mountain chalets are less steeply sloped, because they have to bear the snow, and in midwinter the peasants prefer to keep on

their roofs the covering of snow that protects them from the cold. In the lower mountain regions and in the Swiss *Mittelland* the roofs—ridge-roofs or curb-roofs—are much more steeply sloped, to allow the rain or snow, which is less abundant, to run or slide off more easily.

The main problem of the roof, however, is not so simple as it seemed when we began the study of human geography: it is not only a geographical problem, and for that reason we shall return to it later, in connexion with our map of the roofs in France (see Chapter IX and Map XL, p. 231).

To the north of Berne the house is completely covered by its roof as by a hood: the roof is like a cap of thatch or wood coming down to within six feet of the ground and almost hiding the walls. It descends on four sides with a steep and regular slope, and the house cannot breathe the fresh air on any of its sides. It is difficult even to catch a glimpse of the foot of the door, or in some cases the edge of a window, between the lower edge of the roof and the ground (see Fig. 32). Here is a description by Emmanuel de Martonne of a wooden house in a different region, a long way from the Swiss plateau—the Paringu massif in the Southern Carpathians: "The architecture of the *stîna* is of the simplest. The walls are generally formed of unsawn tree-trunks resting on corner pillars set in the ground. The air passes freely through the unplugged interstices. Sometimes there is a kind of basement made of unmortared stones. The roof, two or three times as high as the walls, is placed on top like a lid which can be taken off, and is shaped like a boat with a straight keel and front and back faces. It is made of wooden laths nailed one over another like slates."

The wooden house extends just as far as the forest does. We cannot here deal with the problem of the causes of the steppe, but it is a region in the middle of Russia where the forest trees first become scattered and then disappear, giving place to great carpets of graminaceous plants, beneath which is formed, and extends, the rich 'black earth' (*tchernoziom*). There we find the *isba*, built of dried earth, turf, or mud, the whole often covered by a dazzling coat of whitewash.

In the North German plain, marshy and sprinkled with lakes and peat-bogs, the wooden house also vanishes, being replaced by houses with walls sometimes of brick and sometimes of turf or wattles, as in the fen country of Frisia.

Farther north the forest ends, and wood plays quite a minor part. Entirely typical of this is the Icelandic farm, where the house walls are built for the most part of turf and earth, and the front alone is faced with planks.

Throughout Western and Central Europe the forest is restricted everywhere by enormous clearings in the form of strips, blocks, or islets, and here there is an infinite variety of dwellings, with stone and wood mingled in different proportions in the country houses.

But the forest is subject also to another limit, that of altitude—the height above which trees do not grow. Above the forest stretches the *alp*, where the chalet in which cheese is made is a stone hut, like the chalet of the Bernese mountains or the herdsman's cottage of Valais. The Bernese chalet is still quite near the forest, and even if it has stone walls it may be that the very trim roof is cleverly constructed of small wooden tiles. (See Fig. 32.) One still clearer feature is met with in Cantal: above and beyond the forest we find a better kind of pasture, and the *buron*, or shepherd's hut, which is generally built entirely of stone. Houses in the bare Caucasus mountains are likewise of stone.

Lastly, in the south of Europe the forest has been unsparingly exploited and become sporadic. The wooden house stops as a rule when we reach the Mediterranean area, some of whose building methods will be examined shortly.

But what of the future? Along with the deforestation considered necessary as the condition of settlement in our lands, there has too often been let loose a utilitarian and destructive deforestation, which we shall have to deal with more fully in connexion with 'destructive economy' (see Chapter V). And, apart from man, the forest has many other enemies also, such as avalanches and floods, and, what is the most serious of all, fire. This is the enemy of the wooden house as well, and many such houses and villages are burnt down every year.

Now, the result of this ordeal by fire, and the fear of it that continually threatens these wooden buildings, is that sooner or later they have to give way, as it were, and be replaced by houses of stone or brick. In the Siberian forest—a continuation of that of Russia—the city of Irkutsk took on its new form and its title of "Irkutsk the White" only after a fire which completely destroyed it. So also Meiringen, in the Bernese Oberland, was rebuilt of stone after being destroyed, and the same thing happened at Neirivue and Planfayon. Governments, concerned about the fire peril, make laws prohibiting the building of new roofs of thatch or shingles, and little by little, as roofs are repaired, they are made of tiles, slates, or zinc, even in the ancient and traditional home of the wooden house.

In this way the extension of the wooden house, like that of the forest, is becoming more and more limited by the geographical effects of fire.

A similar study of the existing types of human habitation in the Mediterranean area would enable us to establish in the same way what may be called the chief general responsibilities of the geographical environment. Whatever may have been the earlier condition of the vegetation in the Mediterranean region, however beautiful and numerous the forests on the eastern shores of the Adriatic or in Lebanon, however extensive and dense certain forested areas may still be, such as those of the Maures and Esterel mountains, and however heavy the rainfall in certain districts, like the Bocche di Cattaro, Mediterranean Europe stands to-day in contrast to the forested Europe just described, as a region stripped bare differs from one that is covered with verdure.

All round the Mediterranean rise mountain-chains or massifs showing the bare rock. The stone is there, and almost everywhere we find stone houses—in Spain, Provence, Liguria and Calabria, Dalmatia and Herzegovina, as in Sicily and Greece, in Jerusalem, and at Tunis and Algiers. Moreover, the stone house, by the very nature of its materials, admits of far more fanciful variations than the wooden one, and if we were to undertake here a general and detailed study of the stone house, as we did of the wooden one, we should find it still more necessary to give a regional form to our study. (See Figs. 25–28, 46, 47, 56, and 89.)

A remarkable study of the very curious types of building in Apulia was published by Émile Bertaux in the *Annales de Géographie* (1899).

(i) In the provinces of Bari and Taranto, the ancient *Apulia petrosa,* or 'stony Apulia,' where the soil is a limestone that splits into thin slabs, the inhabitants build houses and shelters by arranging these flat limestone slabs in circles without any mortar, and placing these horizontal rings one upon another. These circular rooms are covered in by progressively reducing the diameter of the rings and finishing off the dome with a great flat stone on top. Sometimes the outside shape is that of a frustum of a cone, or, rather, of several such frustums one above another, as they contrive to make two or three tiers on the outside: that is called a *trullo.* Sometimes the whole building is covered by a conical roof made of small limestone tiles called *chiancarelle*, and the building is then called a *casella.*

(ii) These *trulli* and *caselle* are strictly confined to the geographical zone of the limestone slabs.

(iii) On the other hand, similar constructions are found in the Balearics, at Gozo, etc., and even

in quite dissimilar geological regions where the constituent rocks can be easily split into thin plates, as in Ireland and the Hebrides.

(iv) To the same type belong the ancient dry stone buildings whose ruins have often been described by archæologists—namely, the *talayots* of the Balearics and the *nouraghes* of Sardinia.

(v) It would be wrong, however, to regard the *trulli* and *caselle* as primitive forms of dwellings in Apulia. On the contrary, the region where they are most numerous has been populated only for two or three centuries. Where now stands the largest town of *caselle*, Alberobello, a town of 9000 inhabitants, at the beginning of the seventeenth century there was nothing but "a chapel in the woods."

One of Bertaux' happiest observations is about the resemblance between the constructional types belonging to different regions, but carried out with the help of similar materials—in this particular case limestone rock split into slabs. We cannot, indeed, insist too strongly on the fact that the materials used by man often lead to certain types of construction not because of their internal characteristics—chemical, mineralogical, or geological—but simply by reason of their physical characteristics of hardness, strength, or customary form. (See Figs. 25–27.)

We have seen houses, for instance, at the foot of Mount Hermon, and also at the end of the lava flow of Hauran, that were roughly built, without any order or symmetry, of solid limestone in the first case and blocks of basalt in the second—white stone and black, dissimilar in so many respects, yet providing for building purposes the same characteristics of strength and toughness, and occurring in these localities in the form of scattered blocks.

The Mediterranean world, despite the original and distinctive features of the houses in its various regions, provides more than one curious instance of resemblance between houses very far apart which are connected by no common ethnic influence, but have been born, as it were, of a like soil. Thus a thatched stone house standing on the bare limestone plateau of the Crimea bears an unmistakable resemblance to the stone house, somewhat rough and similarly thatched, which appears here and there on the lofty tablelands of Algeria, as well as to the houses near the upper course of the Jordan.

The immediate surroundings of the Mediterranean, however, are not all rocky. Even within the coastal zone itself we find a series of plains and lowlands, which are sometimes rich and extensive alluvial areas like the plain of the Po, sometimes small depressions among the mountains, sometimes mere deltas, and sometimes even areas of mud and marsh. In these deltas and moist zones the houses are built of dried or baked earth, and sometimes of plain mud, and though the little mud dwelling of the *huerta* in Valencia, called the *barraca*, is covered by a slender and rather elegant ridge-roof, the wretched mud houses on the poverty-stricken plain of Sharon, at the other end of the Mediterranean, between Jaffa and Mount Carmel, have horizontal roofs of mere earthen clods resting on slender beams. It is only beyond these muddy areas that the stone house reappears, in what may be called stony Palestine, stony Spain, and stony Greece or Italy.

This dependence on geographical conditions is in one sense quite natural, but it yields theoretical consequences of such a kind that it is as well to examine rather more closely a typical case of this geographical juxtaposition of the earthen house and the stone house in a small area, forming a real natural human unit—namely, the lower Nile valley (Lower, Middle, and Upper Egypt).

Moreover, the stone house itself is only entirely free from wood in exceptional cases like that of Apulia, and it often happens in the Mediterranean region that very skilful use is made of short and small logs of wood. (See Fig. 44.)

The Egyptian House (Earthen and Stone Houses)

This present life counts for little in Egypt, where true buildings are constructed only for the dead. The dead have always had majestic and even gigantic dwelling-places. The gods, too, have their temples, and what temples they are! It is only for himself that living man does not trouble to build. He lives outdoors, in the sunshine. He has to work in his own or another man's field the whole year round, without ever a day of rest on the soil that can never be left idle, so that he has no need of a shelter for the long, dark winter evenings, like our peasants. He lives from day to day, gathering in his wages every day as he picks the bundle of *ber-seem* (clover) for his ass and his buffalo cow, and his dwelling need not be big enough to be used as a granary.

Besides this, everything needed to build a solid dwelling is lacking in the Delta: there is neither limestone nor any other kind of stone, and wood is a rare and precious commodity, reserved for the *sakieh* or the plough. All that is obtainable is the Nile mud, which, to be sure, is the easiest of materials; it can be moulded without difficulty, and hardens quickly. The roof is a harder problem, so in some cases the *fellah* does without one and lives under the open sky by night as well as by day. Nearly always, however, he does make a roof: on one or two beams or a few branches he lays a network of straw and covers it with mud. Thus the five sides of the house look exactly alike, for they are all made of the same material—the soil beneath one's feet. A further inducement to make a solid roof is that a flat roof provides the *fellah* with a simple and unique storehouse, for it is there that he puts in little heaps the slabs of dung that form his fuel and the bundles of straw that he has collected. Sometimes one sees a vaulted roof (in Upper Egypt) or a small dome (in Lower Egypt) made of baked bricks (see Fig. 31). This kind of roof is more substantial, but it provides a smaller surface and is less useful as a storing-place. And as care for the morrow is quite a secondary matter to the *fellah* in comparison with to-day, he will only very rarely resort to this kind of roofing: he would rather have his mud roof demolished time after time by the rain than give himself trouble over the housing of his modest stores. The little dome or cupola predominates in the villages (called *ezbehs*) built by the great landowners of to-day to house their permanent labourers, or *tamaliehs*.

From Aswan, however, and even before reaching Aswan, the Nubian tablelands of sandstone approach the river, and between them and the river there is generally only the river-bank left uncovered by the fall of the Nile. The houses are very few and far between, and situated just where the highlands have left a little more room for man. The inhabitants devote to cultivation the few square yards of almost level soil that lie near the river, and have put their houses between this narrow belt of flat ground and the slopes of the plateau. Being thus already on the rock, these are naturally built of stone—regular cubes of stone, with a single opening in front to serve as a door. Sometimes they are even in the rock.

Thus in one country, with similar inhabitants throughout, the houses, though fundamentally of the same type, take two quite different forms—the mud house in Lower Egypt and the stone house in Upper, or stony, Egypt. We have described elsewhere (in our book *Irrigation*) the special features of the Faiyum, that great oasis with a more smiling, Mediterranean appearance, that is really an outlying appendage of Egypt proper, drawing its water and its life from an arm or effluent of the Nile, called the Bahr Yusef. "It is an Egypt with relatively great differences of level, and an oasis fed by a river whose course is relatively regular." In the Faiyum everything is smarter, better finished—one might almost say more artistic. The houses are of the same type as in Egypt, but just as their approaches and surroundings are neater, so also the lay-out and the details of the clay walls reveal a more developed taste, and even art. (See Figs. 29 and 30.)

When numerous detailed studies have been made of these representative and truly geographical types of human dwellings it will be possible to make certain generalizations about the form of the house, which can then, no doubt, be suitably gathered together. Here are some examples of such generalizations.

From researches made in the lands of the wooden house it would appear that in buildings of secondary utility, such as stables and barns, the characteristic features of

the older method of construction are retained for a long time, even when new circumstances have caused the old wooden dwelling to be replaced by a different kind of building. And not only are houses replaced by others after a fairly short time, but they have also to be repaired, and the study of these successive repairs would undoubtedly reveal some interesting geographical laws concerning the transformation of the house. Thus in the Black Forest thatch is replaced by shingles, in the Fribourg Alps flat slates or tiles take the place of wooden shingles, and even the walls are partially repaired—and so forth.

Certain secondary details in the forms of houses are explained by similar reasons, showing a common feature in types of dwellings very far apart and entirely unlike each other. Thus to preserve their rice from rodents the inhabitants of the district of Imerina, in Madagascar, put large horizontal wooden discs at the base of their granaries, which serve the same purpose as the great slabs of schist which the people of Valais place at the four corners of the bottom of their *racarts*, and which are found also in the Norwegian *Stabbuhr*. So, too, we could even compare the granaries built on piles that are set up by some northern peoples, in Canada, and in Indo-China, to protect their provisions against animal raiders (see Figs. 15 and 16), the dovecots of Agen, the *horreos* of Asturias, and so forth.

2. Physical Characteristics of the Street and the Highway

Even the smallest of human establishments is accompanied by some visible signs of coming and going in the form of trodden patches or paths. The poorest mountain chalet or shepherd's hut in our part of the world stands at the end of a line traced upon the ground, by which men or beasts approach this tiny centre of human life. (See Fig. 36.) As soon as houses become clustered together the coming and going increases, and the thoroughfare begins to appear in more or less definite form, as a more or less regular space between the houses. But it is still the geographical expression of all that communications mean, even in their simplest form—*i.e.*, the movement of men, the transport of goods, and trade. (See Figs. 60 and 78.)

Wherever primitive roads cross in a hamlet or village, there are born the 'cross-roads,' the rudimentary form of the square, or *place*, and very often of that area specially marked out for trade—first the local market, and then, in a later stage of development, the fair-ground.

The most rudimentary types of traffic routes have been described in their geographical significance by Ratzel and Hettner as the footpath, the mule-track, and the carriage-way. But it may be that Ratzel paid too little heed to the connexion between the appearance of the road, especially in its developed form, and the geographical setting. Not only do the desert track and the path cut through the virgin forest form part of the landscape, but the great highway itself—by its construction, its windings, its gradients, its surface material, and even the colour given to it by this material—is a geographical fact. (See Figs. 37–39.) Even the city street itself has its geographical features. (See Figs. 40–44.)

Toulouse, a city of brick, is built on the Quaternary gravel of one bank of the Garonne, and the stone that is lacking for house-building is lacking also for making streets, so before recent developments in methods of transport the roads were paved with rounded cobblestones taken from this Quaternary gravel. And every one admires the streets of Funchal, in Madeira, paved with stones of basalt so hard and well-fitted that they make no dust.

There are some thoroughfares that are made already by geographical conditions, so that man has had to make only slight changes in the parts most useful to him. Of this kind are all roads on snow and ice. Thus it is well known that the winter is the season for

traffic in Russia beyond the Volga, simply because the roads are then ready marked out by snow or by the ice on the rivers and lakes. So, too, in the Alps the transport of supplies of wood or fodder is put off till the winter, when they can glide easily over the snow; when the winter is mild and the snowfall scanty, as in 1911–12, the necessary transport cannot be completely accomplished. In many rough and wooded countries timber is brought down gullies on sledges, as in the Vosges and the Black Forest. From this point of view waterways in almost all cases belong to the geographical setting, though men rarely use them without making some change in their essential features.

In any case the slightest improvement in methods of travel on land is reflected in surface phenomena, whereas improvements in sea travel leave the surface of the globe as unaltered as the air is by the progress of aviation. The places where progress in navigation and aviation leaves its mark most clearly on the earth are where the latter is in contact with the sea and the air—*i.e.*, the landing-points. Here are set up airfields, ports, or railway stations—the visible termini on land of air- and sea-routes.

Means of communication have, then, their geographical effects on the highways. The wheels of chariots have made grooves in the streets of the dead cities of Pompeii and les Baux as in those of modern towns. Steam, electric, and petrol traction have given birth to ribbon-like highways of a new physiognomic character.

It is not simply a matter of the superficial appearance of these roads, but of what may be called their technical physiognomy. Steam traction compelled the engineers to reduce the gradients of the old highways. The funicular and rack railway make it possible to have gradients of almost any steepness, but the range of some mountain roads and city streets is greatly restricted. Electric traction will in future be increasingly used, and admits of much steeper gradients than steam, while very great heights can be reached by means of telpherage.

The increased speed of the motor-car and the attention given to greater and greater speed have led to the construction of special motor roads.

The form and appearance of the roads are expressions of human geography, just as indicative of human development as those of the house. (See Fig. 82.)

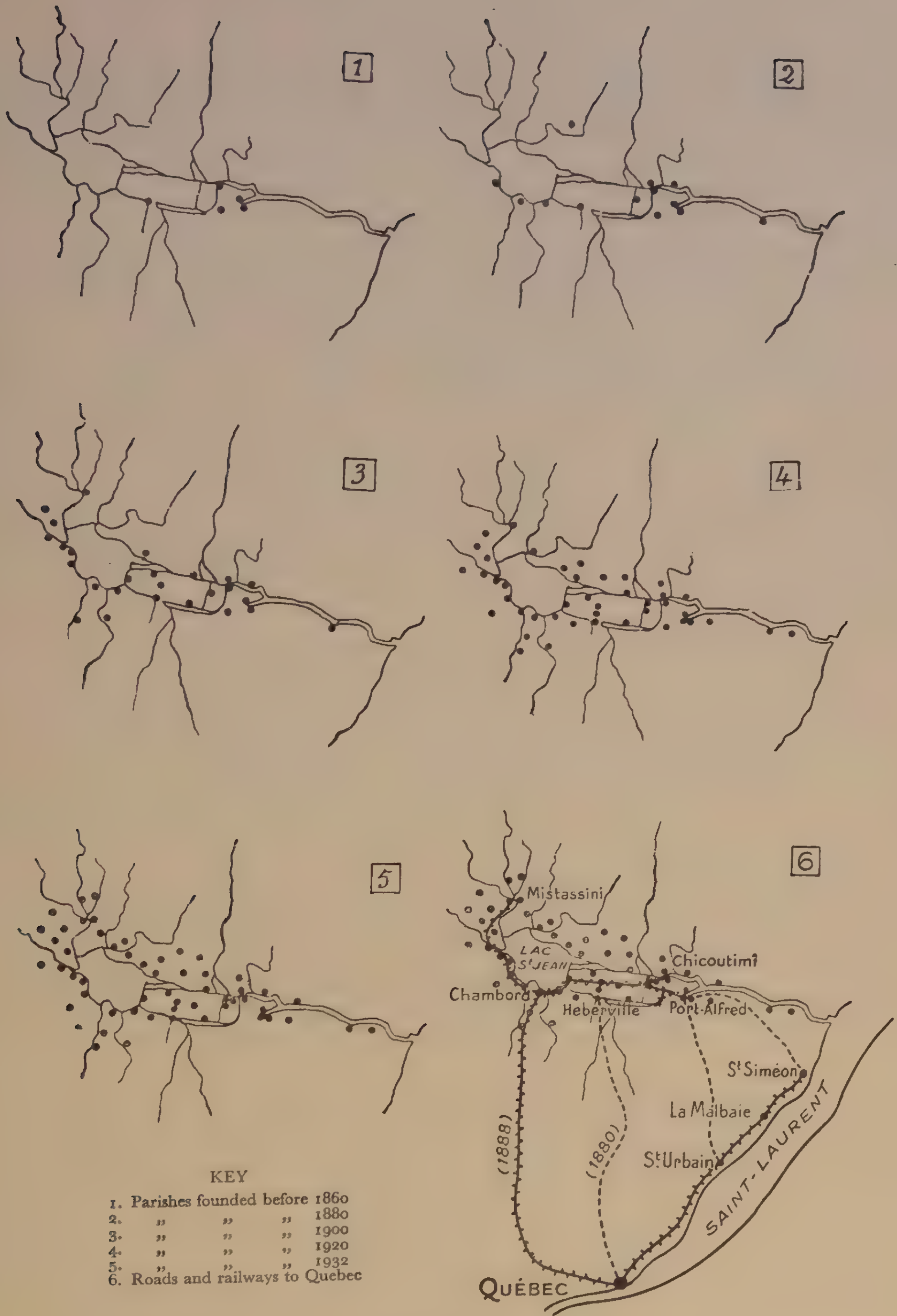
"The Roman roads are primarily strategic routes intended to facilitate the movement of troops, and the road system was extended as Roman domination grew. Their strategic character explains why the Romans, desirous above all of speedy communications and military transport, paid no attention to the natural irregularities of the ground when they built their roads, which are, as far as possible, straight lines. Artificial devices, too, are very numerous, such as bridges thrown over valleys;

**Map VI*

How a New Country is progressively peopled: Human Settlements and Thoroughfares in a Newly Cleared Area in Quebec

The region shown is that of the Saguenay river and Lake St John, where the first settlers penetrated by waterways, along which the first parishes were established. Colonization started at the western end of Lake Kenogami (Herbertville) in 1849, and spread westward for thirty years, being localized first on the southern and then on the western shores of Lake St John, appearing finally on the north-east. After 1890 some parishes and an important monastery were founded on the banks of the Mistassini river (see Fig. 1), and then the 'circle of colonization' was gradually closed round Lake St John. In 1880 a road had been made joining Herbertville to Quebec, being indispensable for the export of agricultural produce and to facilitate further clearing of the land. In 1888 the construction of a railway began, to assist the more intensive development of the region. Note also how the settlement of the area went hand in hand with the progress of means of communication. Blanchard says that the present position of the Lake and the Saguenay dates from the coming of the railway.

*Reproduced, by courtesy of the author, from Raoul Blanchard, "L'Est du Canada français: Province de Québec" (Paris and Montreal, 1935)**



MAP VI

[*See opposite for legend.*]

embankments (aggeres) to fill up hollows; piles, causeways, and masonry on marshy ground, as on part of the Appian Way; huge supporting walls on the sides of ravines; cuttings and even tunnels in the mountains. The Romans were not content with levelling the ground: to ensure a solid road they built it instead of merely cutting it through."[1]

The distinctive features of the street and the road, their arrangement and number, serve to indicate the intensity and importance of human relationships.

The 'spreading-out' of every human establishment is shown by those more or less artificial lines, of varying precision, that surround it (see § 5). The thousands of miles of national roads, secondary roads, and railways in France express a great number of facts, historical and economic, general and local. (See Fig. 70.)

Ratzel has often noted the fragmentary character of the first sections of a road. In the earliest stage of a new kind of locomotion men are most clearly subject to the tyranny of geographical conditions. Thus the valley of the Visp, at the head of which stands Zermatt, has long been a typical example of an interrupted road. There was a strip of carriage road from Saint-Nicolas to Randa that was not linked up with any larger road system. Here and there it led to paths only wide enough for mules. In the same way, railways originated in the form of very small sections. But any geographical area in which little or no attempt has been made to plan connecting roads can serve only a community whose range of political and economic activity is limited. *And, conversely, any geographical area in which new traffic routes are laid down becomes an area of increased human and economic activity (see Map VI).*

8. Characteristic Features of Human Establishments

Geographical Types, as exemplified by the Typical Egyptian Village

Houses and streets are arranged and combined to create all kinds of communities, ranging from little hamlets to the greatest cities. Ratzel has noted the various historic forms of these communities, especially in Germanic lands, as follows: *Hof* and *Gehöfte* (small isolated farm or large farm), *Zeilen* (houses on the slopes of a hill or along a *thalweg*), *Weiler* (hamlet), *Marktflecken* (market-town with fair-days), *Landstadt* (town that lives on and for its rural outskirts), and so forth.

Having already dealt with the typical house, we would here stress the very great importance of the typical village or small town. The typical village is a geographical fact in itself, because it expresses the character of a region and because of its relations, in appearance and situation, with the whole of its immediate surroundings. (See Figs. 54–67.) As we have examined in some detail the Egyptian house, we should now see how these houses are grouped together to form the Egyptian village.

The Typical Egyptian Village

As with the house, so with the village: both alike are fragile and short-lived. Nowhere else can be seen so many superimposed ruins—so many villages that in the course of centuries have become piled one upon another. Both alike are low and colourless. The houses, however, are generally clustered on slight eminences that are clear of floods, and the ruins that accumulate in one place tend to be constantly adding to the height of this slightly rising ground. So the village stands up like an islet, and the cluster of low houses stands out just enough to catch the eye, especially in Lower Egypt, where there is nothing else to break the long, continuous line of the horizon. (See Fig. 58.) So also a village that has the brown hue of the Nile mud would not be noticed on a plain of the same material and colour; but the ground is rarely bare, for it is covered with crops, and the drab village thus

[1] *Lexique des antiquités romaines*, ed. R. Cagnat and G. Goyau (Paris, 1895).

shows up by contrast and catches the eye. Against this background of simple form and hue the smallest vertical line and the slightest trace of colour assume astonishing importance. The dingy white minaret of a very small mosque is enough to give unity to the village and relieve its wretched appearance; but mosques are rare in the villages.

Since villages are constructed like this, any merely subsidiary buildings acquire a disproportionate importance. For instance, throughout Upper Egypt the dovecot, shaped like a quadrangular pyramid and whitewashed on top, is the salient feature of the village, standing out like a monument among the human dwellings. On this cultivated area the soil becomes exhausted by the unbroken succession of crops, and the peasants seek to remedy this impoverishment by one of the few kinds of fertilizer available to them—pigeon dung. That is why pigeons are treated with respect and their dwellings are more luxuriously equipped than those of their owners.

After the mud villages there comes, farther south, the stone village on the barren river-bank, where the scanty and scattered crops, and even the houses themselves, find it very hard to exist among all those rough and smooth rocks. Above Aswan, and particularly from Bab-el-Kalabsha onward, the houses are built of stone, and the villages recede towards the uplands. They are scarcely visible behind the screen of palms that closely follows the river-bank, near to the stone of which they are built, just on the dividing-line between the narrow strip of open country and the mountain region of great tumbled blocks.

On the Nubian bank of the Nile stands only the *sakieh*, also of stone, a massive round turret that strikes the eye in this land where everything built for the present life is so frail and ephemeral—the stone village almost as much as the mud one.

In the Faiyum the villages, like the houses, are somewhat more prepossessing. There are more trees, and the principal water-course, the Bahr Yusef, an overflow channel of the Nile, has a more regular flow, owing to the double regulating device at El Lahum, so that the inhabitants can dwell quite close to it. In short, the villages and small towns of the Faiyum, though of the same type as those of Middle Egypt, are even more closely connected with the river. Even in olden days houses and a mosque were built on the Bahr Yusef, and the bridges of Medinet, covered with buildings, were reminiscent of such far-off towns as Florence and Nuremberg.

In the small Egyptian communities, so colourless and flat, the tree is bound to play an extraordinary part. There are villages without a single palm or any other tree, but these are the most poverty-stricken villages, and they are not numerous.

Small cubes of clay almost level with the ground, and the straight and slender stems of palms, their green heads spreading and blossoming far above the ground—these are, from the physiognomic point of view, the essential elements of the Egyptian village. (See Fig. 58.) Sometimes the palms are close to the village instead of scattered over it, and then on one side of the little mass of clay boxes there is a more or less closely packed screen of tall trunks, straight and parallel, through which pass great vertical lines of light. In many cases the date-palm is not alone, but accompanied here and there by great lebbaks, tamarisks, or various kinds of acacia. Nor is the date the only palm to be found, for above Korosko there appears in Nubia the doom-palm, which shares with the date the title of "the glory of the palms."

The *typical* community is in brief that unnamed one, which the tourist does not notice, which is not different from any other community, but which for that very reason recalls and expresses all the others, and is therefore of great geographical value.

Similar Investigations in France

The typical house, the typical village, and later on the typical town are the things that our spirit of inquiry causes us to single out in virtue of their similarities; and since the publication of the great *Enquête sur les conditions de l'habitation en France* [*Inquiry into Housing Conditions in France*] in 1894 general attention has been attracted to the representative importance of these types.

Since "the rural dwelling is primarily a phenomenon of agricultural economy," Demangeon[1] wished to classify rural dwellings "not according to their materials or external form, but according to their internal plan and the relations they create between men, animals, and things—that is to say, their agricultural function." For the peasant "has regarded his house as a working implement and has adapted it to the conditions under which he cultivates the soil."

Demangeon decided on four principal types: the rudimentary house, the compact house, the straggling house, and the vertical house. "Combined research," he added, "will be needed on the spot to determine precisely the area of each of these types, and to show their geographical distribution on a large-scale map. But it is possible to give a rough sketch of their general features and their distribution."

(i) The rudimentary house is the dwelling of the "small farmer who keeps everything under the same roof and on the same level . . . It is a kind of habitation made to suit small-scale cultivation, a system that is very common among the French people."

(ii) "The compact house, known as the Picardy farm or the Walloon farm, occurs in Northern France in a definite area; but it is found also in scattered groups in certain regions where it arose from the needs of a more advanced rural economy or more extensive cultivation, as on the plains of Champagne, Forez, Caen, Berry, and Cerdagne." It is found, too, on the fertile soil of Brie, Beauce, Vexin, the small agricultural plain to the north of Paris called 'France,' Valois, and Soissonnais. "In the compact house the essential farm buildings are always grouped round an enclosed courtyard, where everything is under the master's eye."

(iii) The straggling house "seems to meet the twofold need of more independence for man and better exploitation of the cattle. In this type of dwelling the buildings are all separate from each other and all inseparable from the pasture land." Examples are the Flemish farm and the farms of the Pays de Caux, in Normandy. "It is the mark of a rural economy in which the cattle take precedence and a social system in which man desires greater freedom."

(iv) The vertical house is the kind "which has the cowshed on the ground floor, the living quarters on the next floor, and the granary above. It is self-sufficing and has almost everything under one roof. Its great peculiarity consists in putting the cattle below and the men above. . . . It is remarkable that this type seems to be associated with rural cultivation in much of the south of France. . . . The same fundamental features appear in the houses in part of the French Alps."

Demangeon says in his "Conclusion": "There are certain resemblances which cannot but arouse our curiosity. The vertical house of our southern region is to be found also in Corsica, in Italy, and on other shores of the Mediterranean. The principle of the straggling house of Flanders and Normandy can be recognized in the British farm. The Lorraine variety of the rudimentary house, with its heavy and massive appearance, is to be met with in the eastern provinces of Holland. The compact house with its inner courtyard can be traced from Beauce, Picardy, and Flanders as far as Limbourg and the Rhineland."

Having followed Demangeon's account with scrupulous fidelity, step by step, we find that with a classification based on somewhat general characteristics (rudimentary house, straggling house, etc.) there is mingled also a concern for an ethnical and historical explanation. The first impression one gets of excessive simplification is to a very large extent weakened by the frequent descriptions of 'varieties' and the noting of minute details. But at all events this essay itself shows the great importance of actual observation of what we have called 'primary and fundamental human geography,' and makes one desire especially to be shown such varied kinds of French rural dwellings in their regional setting and their detailed regional form, for it is obviously in studies of this kind that *regional geography* should pre-eminently come back to its own.

It is because of this regional aspect of the facts of human geography that in the first volume of my *Géographie humaine de la France* (published in 1920, some months before Demangeon's article in the

[1] "L'habitation rurale en France," in *Annales de Géographie*, vol. xxix, 1920.

Annales de géographie) I gave much space to a detailed description of many representative types of French country houses, including the Basque *etche* and the houses of Béarn and Limousin, the three types of Rouergue and the two of Brittany, the houses of maritime and agricultural Flanders, the *bourrine* and the ordinary house of Vendée, those of Sénonais, Caux, the Pyrenees. and Corsica, and finally the two contrasting types of Lorraine and Alsace. (See Diagrams VII and VIII.)

One cannot fail to recognize what is fruitful in Demangeon's fundamental points, but it is equally consistent with frank and friendly courtesy to express the doubts and objections suggested by a close examination of them, with the aid of a few brief examples:

(i) It does not seem possible to place in the same class of "rudimentary house" a house as elaborate and even refined as the Basque *etche*, for instance, and a simple rudimentary one like the *bourrine* of Vendée.

(ii) Is there anything to be gained by bringing together in such a classification this same Basque house and that of Thiérache or the Norman Bocage, relating as they do to very different "ways of life"? Demangeon quite rightly finds the phrase "way of life" too complex, and not precise enough, and proposes to say "agricultural economy" instead.

(iii) On the other hand, I do not think there is any *essential* difference between the "rudimentary" house and the "vertical" one. So true is this that the only documentary photograph given by Demangeon of a "vertical" house is of a Basque house, which he himself classes as a "rudimentary" one.

(iv) If we adopt as our criterion and point of departure the "agricultural function" to which the dwelling corresponds, it seems that the houses thus classified should correspond to a parallel classification of ways of life. But if the "compact house" is due simply, as is said, "to more extensive cultivation," that is because it has managed to replace the "rudimentary" house without any change in the way of life.

(v) In the majority of the regions in question the "compact" house or the "straggling" house is found mixed with other types, such as the "rudimentary" house, for example.

It is probably better, then, to describe these dissimilar but co-existing types, and thereby to explain what it is that actually makes up the synthesis of regional life.

Certain geographers have obviously exaggerated the conclusions drawn from a too analytical observation of the different elements or factors that go to make a house, such as the walls and roofs, situation, orientation, and so forth. The author of the new investigation has himself, it is true, made quite clear the legitimate and appropriate consideration of the house as an "actual agricultural implement," but he has perhaps been inclined to give it too exclusive authority as a matter of geography.

An inquiry into rural dwellings, with a view to their improvement, was made in France, under the auspices of the Ministries of Agriculture and Public Health, and the results were published in two volumes in 1939,[1] with an Introduction by Dr Parisot. This important work was instigated by M. Vignerot, who wrote several of the reports included in it. It contains many investigations into the economic and social state of housing in France, documented by abundant photographs, from which geographers will obtain very useful and valuable information.

The *Inquiry into the Rural Dwellings of the Natives of Algeria* was conducted and published by Augustin Bernard.

"The terrace house," he says, "develops little or not at all, because it is the supreme example of a type of dwelling that is no doubt rude but original and perfect of its kind, and therefore gains little ground and changes but little. . . . Unlike the terrace house, which shows scarcely any development and gains scarcely any ground, the house with tiled roof tends to extend its frontiers and make progress towards the European type." Throughout the whole of his study the author remains a

[1] Dannaud, Paris.

Diagram VIII (below)

Typical Plan of an Alsatian House

"In Alsace, where rural cultivation spreads widely over the rich areas of loess, the houses are scattered and the essential buildings are grouped round a courtyard. The dwelling is separated from the road or the street by a small garden. The large and most important apartment, very clean and pleasant, is called the *Stube* (the German word for 'room'), and is placed—one might even say *posted*—at the corner facing both the courtyard and the road. In short, while the Lorraine house, built of fine stone, but with flat, hollow-tiled roof and low walls, presents an outline as straight and monotonous as the Meuse skyline . . . the Alsatian house, with its pointed roof, its flat tiles, and its high walls, has a smart and well-to-do appearance. . . . It is like a village in itself. But the houses do not adjoin one another, as in near-by Lorraine."

See below the 'fundamental seed-beds' of population in the Strasbourg plain (Map XVI) and the plan of a Lorraine village (Map XXVI).

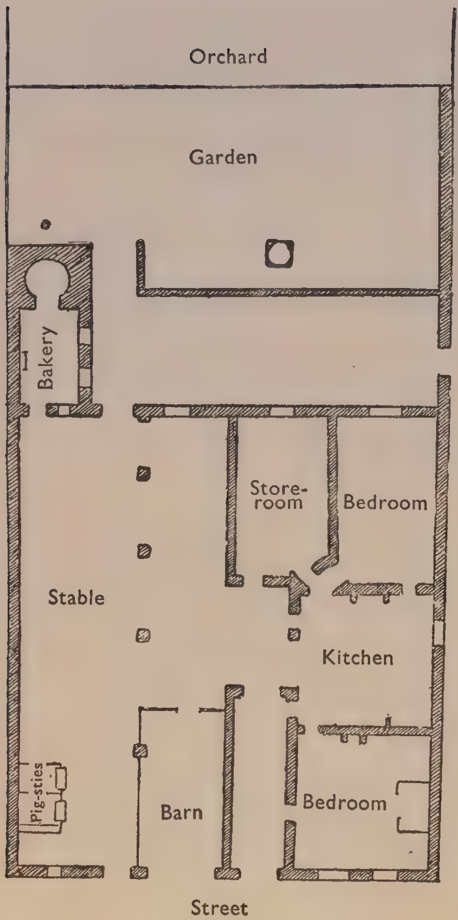
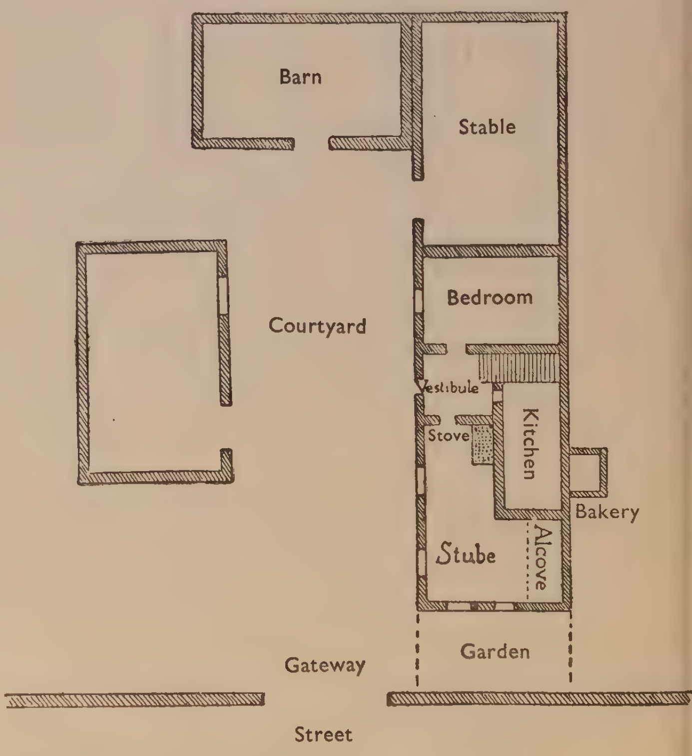


Diagram VII

Typical Plan of a Lorraine House

"The Lorraine village belongs to that group of villages which are constructed according to a regular plan directly related to the highway. . . . Part of the street is, as it were, an appendage of the house, for it serves as barn, shed, and manure-heap. . . . The house has no actual courtyard of its own. It packs into a single building its crops, beasts, and human inhabitants. . . . The front shows clearly the three divisions of the house and their respective importance. The great doorway, one of the glories of the Lorraine house, is the entrance to the barn. . . . On one side of it a lower door leads to the stables, and on the other a small side-gate gives access to the kitchen. . . ."



Diagrams and accompanying text from Jean Brunhes, "La Géographie humaine de la France." *

geographer, without ever straying into the realms of technics, linguistics, ethnography, or folk-lore. His descriptions are illustrated by well-chosen photographs, and a coloured map shows the locality of the objects studied and indicates precisely, in each case, the limits soon to be discussed.

4. Geographical Localization of Human Establishments

Situation—Dispersal and Concentration; the 'Fundamental Seed-beds' of Human Settlement—Limits

(*A*) Situation

The method of observation, which, as we are trying to show, can be fruitfully employed in human geography, bids us classify the facts and examine them logically by associating the simplest forms first with the villages and then with the urban forms. The advantages of this method will be proved by studying new relations between these facts of human geography and facts of the natural order.

Where are these facts of human geography situated—these houses and highways, whether alone or collected in towns and villages? And why do they occupy those particular points in space? The same questions arise in respect of the single house, the village, and the town, and it will be shown in turn that the same natural facts that affect the localization of the house play their part likewise in that of the village and the town.

Situation in relation to the Sun

In all European countries man seeks the sun, and the house is, if possible, orientated to receive the rays of the rising sun. But though single houses on the Swiss tableland, for example, can and do almost all of them turn towards the sun, the problem is not quite the same when houses are built in groups: here the street often plays the decisive part, and the house faces the highway—road or street—instead of the sun. It is even the main feature of the town that—unfortunately for health—the orientation of the houses is determined by the direction and plan of the streets. (See Figs. 2 and 75.)

Between the isolated house and the large village there is a regular series of intermediate conditions, the grouped houses depending for their orientation sometimes on the grouping itself, but sometimes, on the contrary, remaining indifferent to the street or road and facing whichever way suits them best. (See Figs. 46 and 47.)

There are many countries in which the aspect of the house depends on religious beliefs or ceremonies (which are, however, themselves more or less closely connected, in many cases, with geographical considerations). An aspect thus determined causes the house to be favoured by certain mystic powers. In Timbuctoo, for instance, according to Paul Castelnau,

> The houses never face east or west, the direction of the prevailing winds, lest evil spirits and misfortunes should enter them. Consequently there are two distinct kinds of streets. Those running north and south wind their narrow and mysterious way between blind walls whose lack of alignment occasions frequent detours. . . . The roads running east and west have quite a different appearance, because they are flanked by a succession of house-fronts. The dwellings are better aligned, and the streets wider and more lively and animated.

In the first section of the upper valley of the Sarine or Saane river, running north and south, the houses face each other on opposite sides of the valley. But this, though at first surprising, can be explained: in the narrow upper valleys, with very steep sides, the houses generally face the river—*i.e.*, the deep trough, and therefore the open part of the valley—for owing to the shadows cast by the neighbouring heights in the morning

and evening in latitudes such as ours it is the best way to get the greatest amount of light.

Though the houses in a village may often seem to pay less heed to the sun than do isolated ones, the whole village itself, as a unit, does seek the sun. Throughout the Alps can be seen the contrast between the sunny slopes and the shady ones, between the **right** side (*adret* in the dialect of Languedoc and *adra* in that of Fribourg) and the **wrong** side (*ubac* in Languedoc): the right side is in German the *Sonnenseite* ('sunny side') and the wrong side is the *Schattenseite* ('shady side').

Maurice Lugeon published in 1902 his *Quelques mots sur le groupement de la population du Valais* [*Some Notes on the Grouping of the Population in Valais*]. "The influence of aspect [he says] is clearly shown. Statistics, rationally examined, show a population of some 20,000 on the left slope and 34,000 on the right. It is true that in this particular case the right bank, being less steep, should be more suitable for habitation. It is certain that this topographical point increases the difference between the numbers of dwellers on each slope, but it is undoubtedly true that the influence of the sun is the principal cause of this very marked difference. In the district of Conches, the upper part of the valley, the slopes are of almost equal steepness, but the population of the sunny side is about 3000, whereas only 700 or 800 people live on the shady side. All but two or three of the villages are on the side that benefits most from the rays of the sun." (See Fig. 109.)

Situation in relation to Water

It is well known and constantly repeated that every human establishment needs water. The distribution of human beings is very often in direct proportion to the distribution of water. The influence of sheets of water—lakes and seas—is shown by the density of the population on their shores (see Map VI).

"On the Swiss and Savoyard shores of Lake Geneva [writes Forel] we have marked out according to the 1900 census two parallel zones about a mile and a half wide and covering altogether some 96 square miles, the first on the waterside and the second entirely inland. The population of the waterside zone averaged about 1480 per square mile; that of the inland zone about 240 per square mile. Thus the lakeside zone was six times as populous as the country one. Even if we deduct from the first zone the two great cities of Geneva and Lausanne there remain 650 inhabitants per square mile, and, taking away also the towns of Thonon, Vevey, Montreux, Nyon, and Morges, there would still be 400 per square mile left."

Similar conclusions have been reached by Bianchi, who has calculated the density of the population around Lakes Como, Maggiore, and Varese.

On a strip about 500 yards wide round each of these lakes the density of population is about 2000 per square mile for Lake Como, 1400 for Lake Maggiore, and 1300 for Lake Varese. The following table shows in greater detail the population per square mile:

Lake	0–500 yd.	500–1000 yd.	1000–1500 yd.	1500–2000 yd.	2000–4000 yd.	Over 4000 yd.
Como	2000	970	660	480	317	481
Maggiore	1400	507	520	369	377	624
Varese	1300	780	676	845	1183	559

One needs to have lived near these lakes to realize the extent to which they are the

Map IX

Typical Distribution along Inland Rivers (*left*, R. Sjoa; *right*, R. Laagen)

Map X

Typical Distribution in the Coastal Area

Map XI

The Grouping of Dwellings on the Fiords

Map IX. In the great eastern valleys the farms are strung out along the streams and separated by uninhabitable spaces. The road winds from farm to farm. The rows of dwellings are often not actually on the river-banks, but a little higher up, on the sides of the valley.

Map X. Part of the coast to the north of Bergen. The land is deeply indented and fairly irregular. There are glaciated rocks that recall the Schaeren, as well as marshes. The island of Radö is a very characteristic little land of hills. The dwellings, indicated by dots, are scattered irregularly according to the relief of the land. In this area along the Norwegian coast the dwellings are relatively dense.

Map XI. On the interior branches of the fiords the rocky sides are steeper, and often descend sheer into the sea. The dwellings are found either on the flattened spurs or, more commonly, round the river-mouths. The groups of houses never extend very far into the interior of the country. Wherever a more important stream passes through a relatively wide valley, forming an alluvial plain (*Ore*), there are found larger aggregations somewhat resembling villages—for example, Lärdalsören.

Three Types of Distribution of Population in Southern Norway, according to Hagbart Magnus

means of subsistence, the hub of all local traffic—in short, the very centre of the life of the people.

If, however, we pass from the lakes to Liguria, for example, we realize yet more strongly how human dwellings have had to be concentrated where the mountains and the sea come abruptly into contact with each other. On the shore of the sea can be found wide horizons and high hopes, opportunities and movement: all life turns of necessity towards the sea, and is organized close to it.

"The prehistoric refuse-heaps called 'kitchen-middens' show that our forefathers were originally attracted to the shore mainly by the abundance of food thrown up by the tide. Later, and to an increasing extent, the principal social function of the sea-shore was to act as a boundless means of communication. Even to Plato, it must not be forgotten, the Mediterranean appeared as the geographical condition of the grouping of human beings, who gathered there 'like frogs round a pond'."[1]

Corsica is one of the Mediterranean islands with the smallest strictly maritime population. A map of the communes like that prepared by G. Anfossi (*Recherches sur la distribution de la population en Corse*) shows how unattractive the sea is in that island. Thus in the Balagne the maximum density of population is between 300 and 500 yards—*i.e.*, in the olive-tree zone—and in the Châtaigneraie it corresponds to the optimum zone of the chestnut, a food-bearing tree, between 600 and 800 yards. Yet even in Corsica, if we take the *whole island* into account, we shall find that the most populous zone is within eight miles of the coast. And much more is this the case in the other islands, where the sea plays, as it were, a far more important part on land: in Sicily, for instance, the density of population is very great all round the coast.

Turning to the sea-coast regions of the Far East, we find if we go up the wide rivers, like arms of the sea, that the people are almost amphibious, and that the water is covered with fleets of junks. On the Yangtze-kiang, at the confluence of the Han, three cities stand facing each other, so as to form a single threefold city—Hankow, Wu-chang, and Han-yang—the three parts being almost joined together by the multitudes of junks. There, as at Canton, the city disappears in places, or, to speak more precisely, it is concealed from the river by all that goes on upon the water, and by all the rows of small, low, floating dwellings called *sampans*.

In Norway the population is so largely settled in the coastal areas that a map of its actual distribution shows it almost entirely as a coastal fringe. A very precise geographical analysis of the facts of human settlement in Southern Norway, accompanied by three 'samples,' was published in 1898 by Hagbart Magnus, of Bergen (see Maps IX, X, and XI). It shows that on the coast, where the population is greatest, as well as in the inland valleys, where the dwellings are very scattered, the supreme attractive force is water.

In very different latitudes, therefore, the coasts, especially when indented and irregular, have been the places chosen for human settlement. (See Figs. 48–50.)

However, the part played by the coast has very often been exaggerated. Much praise has been bestowed on the coastal inlets and indentations in Greece, Italy, the other Mediterranean countries, and even Europe in general. Numerical comparisons have been made between different parts of the world in respect of their areas and the length of their coastal frontiers, and from this has been deduced the indubitable superiority not only of the shape of Europe, but of Europe itself. All this may have been true when the Mediterranean was (or seemed to be) the centre of the civilized world, and when the convenience of travelling by sea made that method superior to all other methods of travel. But this conception is a relative one, suited to the Odyssey, for instance, as Victor Bérard has so brilliantly demonstrated in *Les Phéniciens et l'Odyssée*, when the only genuine travellers, and especially the only carriers, could not travel except by sea. For many

[1] F. Schrader, "Océans et humanité," in *Revue de l'École d'Anthropologie de Paris*, vol. xviii, 1908, p. 43.

centuries indented coastlines have seemed to be the prime geographical condition alike of political power and of the highest form of civilized life.

Sea transport, it is true, retains to-day its characteristic feature as a major mode of expressing political and economic power, but seaports no longer depend entirely on coastal connexions. On the French coasts of Flanders, Picardy, and Normandy—low-lying or lined by unbroken cliffs—large and very busy ports are more numerous than on the jagged coastline of Brittany or the indented Mediterranean shores of the Maures and Esterel region. Not only so, but some of the most important of the world's seaports are artificial ones, like Shanghai and Colombo.

"The existence and development of a port are not subject to any rigorous determinism. There are not by any means as many favourable sites for ports as there are port areas, and these areas are far from corresponding to the physical facilities offered by the coastlines. They depend mainly on their transit value and the amount of traffic that they carry. . . . In brief, the sites of ports vary with the traffic-needs. . . . Though it is only in some cases that physical conditions operate to determine the choice of a site for a port, they do exercise a constant and powerful influence on its 'lay-out,' and the form or type of the port seems in most cases to have been determined by the nature of its situation.[1]

Situation in relation to Topographical Conditions

Switzerland is a veritable topographical museum of human geography.

If we descend one of the alpine furrows or grooves, such as the Rhône valley, with its wide bottom between slopes that rise straight up from the flat part, we meet with certain irregularities. First there are the great alluvial fans of the Rhône affluents. These are sometimes wooded, sometimes reclaimed and already cultivated by man, sometimes irregular and rocky, scarcely extinct, and ready to reawaken. The floor of the valley is strewn with the curious mounds of Sierre, signs of a pre-glacial landslide that blocked for a time the flow of the river. Finally at Sion there appear on the right bank the elongated projections of triassic or liassic schist that are attached to the main body of the left bank.

All these topographical irregularities have provided natural settling-places above the alluvial plain that was regularly flooded before the work of flood-control was undertaken in the nineteenth century. The mounds of Valangian limestone covered by some traces of glacial action determined the situation of Sierre and Granges, just as those of the anticline of polished schist determined that of Sion, and in much the same way as so many small towns and villages have been established on the cones of dejection—Brigue, Viège, Gampel, Bramois, etc.

These mounds, whatever they may be, appeal to men seeking for means of defence and fortification, not because of their geological character or their origin, but for their topographical value alone. So true is this that towns belonging to quite dissimilar geological and geographical formations yet resemble each other. Compare, for instance, the use made by man of the twin peaks of the anticlinal liassic axis of Sion with that of the two steep mounds of basaltic breccia of Puy-en-Velay. (See Figs. 52 and 53.)

Another topographical feature of the upper valleys whose attractiveness for human settlement has naturally been very great is the *terrace*.

"Our great Alpine valleys show some remarkable examples of terraces formed by glacial action. It is understandable that men should have sought to occupy these level places, so eminently suited to

[1] Jean Brunhes, *La Géographie humaine de la France*.

cultivation. There are terraces on the right flank of Valais that determine the height of all the villages on the slopes, the most remarkable being those of Savièse, Grimisuat, Lens, and Montana. . . . When there are no such level places the inhabitants find it advisable to go higher up to reach the pastures. Thus above Sierre we find Randogne and Molens, at heights of 3900 and 3500 feet, with populations of 300 and 285 respectively. Administratively the communes are larger where there are well-marked terraces, though they comprise different centres. The physical fact seems to create solidarity. Thus Savièse, with its 2049 inhabitants, is divided into eight hamlets, six of them with an average population of 300, whereas above Sierre there are centres just as close together, with populations often smaller, which form separate communes, for here there are no terraces and men's interests are separated by differences of altitude and slope."[1]

Situation and Restrictive Conditions

We have now seen the extent to which the situation of human settlements is influenced by such things as the sun, water, alluvial fans, and terraces. But there are other things, and sometimes even those just mentioned, which in some cases act in *restraint* of settlement. Thus violent floods in the valleys of great unembanked rivers, like the Rhône in former days, prevented men from putting up their dwellings in the lower parts of the *thalwegs*.

Frequently, and especially in all moist regions, men have had to shun land that is waterlogged or covered with stagnant pools.

The wind, too, is in some cases unfavourable to human habitation. In the upper valley of the Reuss the *foehn* blows with great violence—a hot wind, so terrible in its effects, particularly in the spring, that the villages have generally been placed in the side-valleys to obtain shelter from it.

Then, again, there are avalanches. These are periodic phenomena, and in those high mountain valleys where they are prevalent they generally recur in the same couloirs or gullies.

The restrictive influence of avalanches on human settlement has been studied by Charles Biermann in the valley of Conches, in the upper Rhône valley. Here the villages are built between two gullies, so that the avalanches pass to one side. They are crowded and crammed together, and sheltered beneath great forests so as to ensure their survival. Elsewhere the peasants merely dispose their chalets and villages in such a way that the avalanche passes over the roofs without meeting any obstacles.

(*B*) Dispersal and Concentration of Human Settlements: *the 'Fundamental Seed-beds'*

The result of all this entirely relative dependence upon natural conditions is a very unequal distribution of men and human settlements in different parts of the earth. There is no need to repeat what has been said about this unequal distribution (see Chapter II, § 4): what matters here is to lay stress on elementary phenomena; too much close attention can never be given to the modes and causes of this distribution in each particular sphere.

Generally speaking, the population of the higher mountain regions is distributed in oases, so to speak, completely separated from each other. That is the most salient general fact that emerges from a study and a map of the upper valley of the Sarine (Saane). (See Map XII.)

[1] Maurice Lugeon, *Quelques mots sur le groupement de la population du Valais*, p. 64.

If we consider only houses and their grouping we can distinguish in the upper Sarine valley three well-marked regions:

(i) In the first region, the highest part of the river, the houses are very scattered, and rise in tiers from the bottom of the valley to a fairly high altitude on the terraces of the northern slope. There are isolated farms, with haylofts or stables adjoining or close at hand, situated on the level areas that are fairly fertile and suited to rural cultivation. This applies to the basins of Gsteig, Lauenen, Gessenay, and even Rougemont.

(ii) In the second region the dwellings are collected in small groups or hamlets situated on narrow terraces with a 'centre' on the main road. These centres are composed almost entirely of middle-class dwellings or those of tradesmen and manufacturers. Such are the conditions to be found between Château d'Oex and Montbovon.

(iii) In the third region, extending from Montbovon to Gruyères, the houses are grouped in villages with all their subsidiary buildings—barns, haylofts, and stables. The valley is very wide, but easily swamped by the violent floods of the Sarine, which explains the need for this arrangement.

Map XII

Distribution of Permanent Dwellings in the Upper Sarine Valley

After Pierre Hanssen

Only the shaded areas are inhabited all the year round. Especially in the lateral valleys, they form oases, as it were, in the midst of the desert of mountains. (The black lines indicate the crests above 5000 feet.) There are three successive zones in the valley of the main stream: the upper valley (*A*) as far as the Château d'Oex basin, exactly opposite line *B*, overlooking the single dwellings scattered almost everywhere, with only four small villages; from *B* to *C* are fairly wide zones containing little hamlets of from eight to ten houses; below Montbovon—*i.e.*, from *C*—there is a succession of large villages, closely packed together in the midst of an empty space with neither hamlets nor single houses. (The figures below the names indicate heights in feet.)

The more sunny northern slope is preferred, the houses there reaching a higher altitude than on the bleak southern side. They are built near springs and in the shelter of a curtain of forest that protects them from avalanches and falling earth, and if possible at the centre of the property. Building is always on the best land, such as the cones of dejection, even on the south side—for example, Les Moulins. That is the reason for this dispersal of the farms in the valley of the upper Sarine on the terraces on the northern slope.

In the Fribourg valley, from La Tine to Gruyères, it is different: the valley is narrow, the bottom dangerous, the terraces are steep, and the dwellings are of necessity grouped in villages in which all the services are concentrated. The houses, in what are really small towns, are built of stone, but often covered with shingles, whereas the isolated buildings, and those not used as dwellings, are entirely of wood. The sun, however, claims his rights and exerts his full influence. The left bank, being the sunniest, is the most populous. So everywhere, in the Pays d'En-Haut as well as in La Gruyère, the inhabited buildings face south—towards the sun, the dominant factor in the matter.

Hermann Walser studied dispersal and concentration of dwellings, not in a high valley, but on a portion of the Swiss plateau.

The Bernese Mittelland is that part of the Swiss plain that falls within the canton of Berne, between the Jura and the Alps. In this area Walser inquired into the distribution of single farms (*Einzelhöfe*) and villages (*Dörfer*). He divided the area into six natural regions—Seeland, the Frienisberg plateau, Haute-Argovie, the Emmenthal, the part of the Aar valley between Thun and Berne called the Querthal of the Aar, and Bernese Uechtland. Summing up, we may say that the northern region, which is the most unified and situated at the lowest level, is that part of the Mittelland where the village system predominates, while the great molassic tableland in the south, scored by many deep and narrow valleys, is the area of the single farm. A mixture of the two types is found on the Frienisberg plateau, in Uechtland, and in the wide Aar valley between Thun and Berne.

It is clear in what precise form and by what method these studies of houses and communities lead naturally to an examination of the problems of distribution and density of population.

The contrast in Scotland between the scantily peopled Highlands and the Lowlands, where the average density of the population is 356 persons per square mile, is notorious. An area covering 30 per cent. of the country contains 65 per cent. of the inhabitants. The density of population in the various Scottish counties ranges from 21 to 1771 per square mile. The irregular distribution in the three great regions (Southern Uplands, Highlands, and Lowlands) and its various geographical causes has been investigated and analysed in detail by Paul Privat-Deschanel.

Perhaps this is the place for a critical account of the attempts that have been made to show the distribution of population as accurately as possible by graphic and cartographic methods. Only by examining the actual distribution—*i.e.*, dispersal or concentration—can a true picture be obtained. But where does concentration begin? To be strictly logical, there are no really isolated houses—*Einzelhöfe*—in our very crowded civilization, but only houses more or less far apart. (See in particular the valuable treatise of Olinto Marinelli on the difference between a concentrated and a scattered population.)

In the light of the simple and carefully localized examples that have been given it is easy to understand that the inevitable conclusion is that already formulated by Behm and adopted so wholeheartedly by Ratzel, that "a topographical map is the most exact and faithful representation of the distribution of the population in all its details."

Marguerite Lefèvre, an assistant of Professor Michotte at the University of Louvain, used the 1 : 100,000 sheets of the map of Belgium for her investigations, presenting the results in two theses.

In the first, *A Regional Map of the Belgian Population*, she studies first the *fact*, which is the map that contains the fruits of her painstaking researches, and then the *explanation* of the fact. Without any excessive systematizing, various physical and human factors have been taken into consideration.

On referring to Marguerite Lefèvre's map we find two distinct zones, one of concentrated houses in the south and one of scattered houses in the north, and we conclude with the author that there is no correspondence between the human and the physical regions: "This is beginning to be observed to some extent everywhere, and it gives to human geography an autonomous and independent character which it has not hitherto possessed."

The author, with some justification, borrows the term 'community' from the science of botany.

Dispersed Houses. (1) Coastal community; (2) community of large, isolated farms; (3) community of dispersal in groups; (4) community of dispersal in hamlets; (5) community of various types of settlement, called by the author "maximum dispersal," which are analysed and explained.

Concentrated Houses. (6) Community of "nebular villages"; (7) community of "nuclear villages"; (8) community of "cross-road villages"; (9) a not very extensive region in the midst of the Ardennes forest where there are no villages.

At the beginning of a second article on the density of rural houses in Belgium, Marguerite Lefèvre says: "From the fact that population and habitation are very closely connected the conclusion has been drawn by many geographers that a quantitative population map should be a replica of one showing the number of its dwellings. . . . But such an assertion is not true of Belgium."

The very recent work of Marguerite Lefèvre leads to the establishment of some interesting correspondences between the density of dwellings and the weekly or daily migrations of a large number of Belgian factory workers who yet remain agriculturists, and ultimately between the density and the manner of life of the people.

In concluding this vitally important section about the dispersal and concentration of human settlement I must again draw attention to Chapter XV of the first volume of my *Géographie humaine de la France* (1920), dealing with what I have called 'the fundamental seed-bed' of human settlement. This chapter is accompanied by some samples of such settlement in France, aided by typical extracts from the 1:80,000 map. (Four of these samples are reproduced here: see Maps XIII–XVI, and also Figs. 64–67.)

*"These maps—these fragments of our soil—are samples chosen from among the sheets of our 1 : 80,000 Ordnance Survey map. . . . One cannot fail to be struck by the extraordinary variety of these human adaptations, sprung from long centuries of history. It is not the houses alone that need consideration, nor even the towns: it is the pattern, the 'fundamental seed-bed' of human settlement, a more or less closely woven network on which is built up the entire range of centres of population.

"Note the complete isolation and dispersal of dwellings on the clayey soil of Flanders, and, in contrast, the grouping in large villages on the rich Alsatian plain of loess surrounding Strasbourg. Between these two extreme types are the intermediate ones to which belong the Limousin hamlets and the diffused villages of the Pays de Caux.

"Note also that no one country or portion of a country possesses a single type of settlement. Apart from a few rare examples (Alsace), settlement arises most frequently from the association of at least two different factors, which are sometimes combined in the same 'realm'—for example, the isolated farms and small villages of Limousin—and sometimes confined each to its own zone, the former in the valleys (as in Béarn) and the latter on the tableland."*[1]

(*C*) Limits. Various Factors of Localization

It should be the concern of every investigator to establish and set out on a map the limits, both in latitude and in altitude, of the phenomenon under examination; and several geographers have engaged in research of this kind.

[1] *La Géographie humaine de la France*, Chapter XV.

Map XIII

Flanders

Extreme dispersal of dwellings. No real concentration at the centre of the commune.

Map XIV

Limousin

The 'fundamental seed-bed' is formed by the association of small villages and scattered farms.

MAPS XIII–XVI. THE 'FUNDAMENTAL SEED-BED

By courtesy of the Institut National de Géographie (Minist

Map XV

Pays de Caux

'Nebular' villages—the houses, separated from each other, form little diffused nuclei.

Map XVI

Strasbourg Plain

All the houses, crowded into villages (note the suffix *-heim*), form islets in an uninhabited countryside.

n Settlement—Dispersal and Concentration

Publics, des Transports, et du Tourisme). *Scale* 1 : 80,000

The highest villages of the Swiss Alps are as follows:

Village	Height	Population	
	(ft.)	1910	1930
Juf, near Cresta	6900	24	24
Findelen (Valais), a summer village	6800	—	—
Tartar (Thusis)	6500	155	174
Cresta	6300	33	38
Avers (Hinterrhein)	6300	183	185
Chandolin, a permanent village	6300	204	159
Lü (Münsterthal) (Grisons)	6200	70	57

We are indebted to Olinto Marinelli for some very suggestive observations on the limits of the various types of temporary dwellings, in the Eastern Alps, and especially Venetia.

In the Alpine form of *nomadism*, connected with the pastoral areas, which are far less extensive than on the great steppes, the place of the nomads' tents is taken by stronger constructions, though they still retain the character of temporary dwellings. Under this head Marinelli includes the *stavoli*, *fenili*, *casere*, and *ricoveri*, which succeed one another up the mountain-sides in the Alpine valleys of Eastern Venetia (Carnic and Cadoric Alps), after the permanently inhabited villages.

It is as well to define, as Marinelli does, the types or significant physiognomic features of construction, and to determine their limits. We have tried in various investigations to obtain similar results, and examples will be found in our *Géographie humaine de la France*.

After studying the Italian regions we pass to the Balkan peninsula, though without moving far from the Adriatic.

The greater part of Herzegovina and even a small western part of Bosnia, the district of Livno, are strongly influenced by the Mediterranean type of climate, but this influence stops towards the east and north—*i.e.*, generally and approximately speaking, at the frontier of Bosnia. The latter is a damp country with fairly hard winters. It is a wooded country, whose cultivation and stock-raising are of the damp European type. The landscape is that of an area where timber is abundant and plays a part in all simple building, such as houses and villages, bridges and mills. The steeply sloping roofs are made of long wooden battens. (See Figs. 34 and 55.)

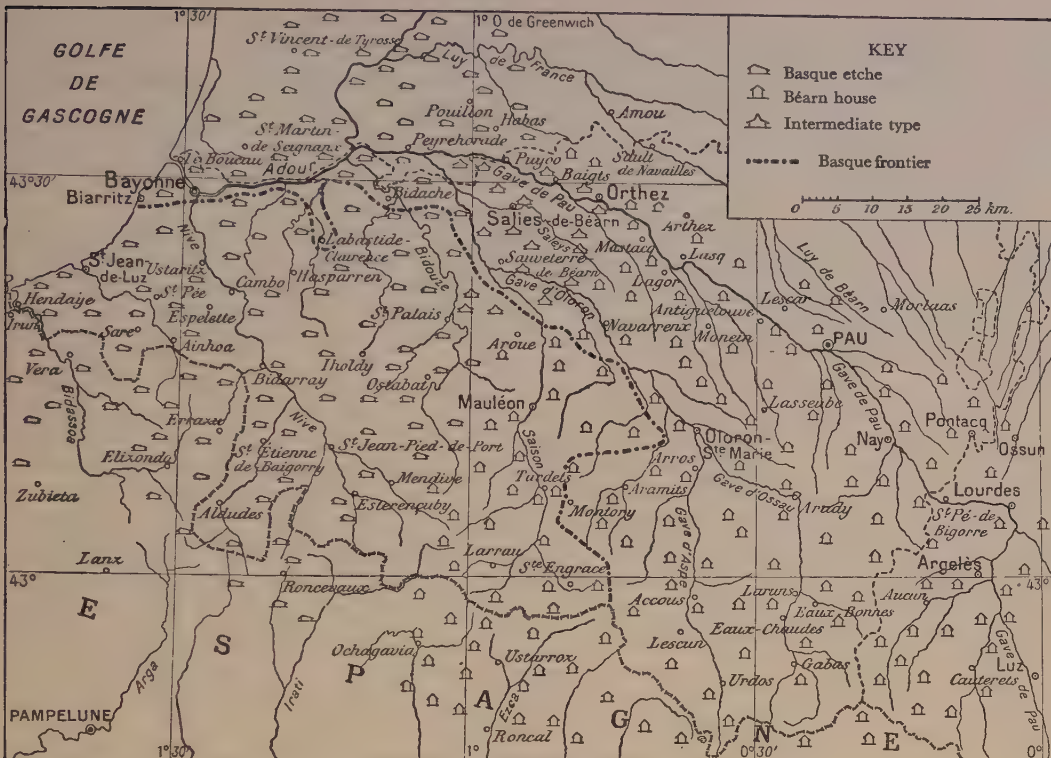
Herzegovina is a land of great calcareous plateaux, rugged and bare, often covered with eroded limestone (*lapièz*). It is pre-eminently a *stony* country, and the houses are built entirely of stone, roofed with great slabs or flags of limestone. (See Fig. 35.) The bridges, such as that of Buna and the old Mostar bridge, are also of stone.

The Bosnian towns of Sarajevo and Jajce are only, as the crow flies, about fifty and eighty miles respectively from Mostar, but no more striking contrast could be imagined than between their landscapes and the forms taken by some of their essential features as human settlements. It would be advisable, indeed, to return to this contrast and follow it up in connexion with a far more complex order of facts. (See *La Géographie humaine*, second and third French editions, p. 917.)

It was obviously the same kind of purpose that led Vidal de la Blache to include a map entitled "Materials and Development of Building Methods" in his series of carefully drawn general maps of the world called *Environments as Independent Developments of Civilization*.

The house shows the influence of human labour even in its shape, and many such statements as the following can safely be made:

"Whereas in some great agricultural plains the barn seems to dwarf the house, taking up



Map XVII

Two Types of Houses opposite to Each Other: the Basque *Etche* and the Béarn House

These two well-marked types face each other and stand close together without mingling: only at a few places, carefully indicated, is there a curious composite or intermediate type.

Map by Pierre Deffontaines, from Jean Brunhes, "La Géographie humaine de la France." Scale 1 : 1,000,000.

three-quarters of its height, here, on the contrary, in a vine-growing country, the house seems to be supported by the cellar."[1]

The houses of the hop-growers in Franconia have their first floors several stories up, to allow for drying-rooms.

There are other strictly human factors, too, that affect the location of human settlements, and the importance of those of a religious and historical kind, for instance, cannot be over-emphasized. (See Figs. 68 and 69.)

A town may remain in surroundings that are geographically abnormal through the intensity of its historical life. Jerusalem, for instance, has no longer the aqueducts that she once had, for the reservoirs called "Solomon's Pools" are no longer working, and she has only a couple of small and unimportant springs. Yet Jerusalem's historic past supports 125,000 inhabitants on that rugged Judean plateau with nothing but tanks to supply them with water.

Furthermore, an entirely artificial settlement may be created by some definite political interest.

[1] Demangeon, "Le Kaiserstuhl (Brisgau)," in *Annales de géographie*, vol. xi, March 15, 1902, p. 152.

Thus Aden is a post that England jealously guards, though in such inhospitable surroundings that some of the fresh water it requires has actually to be brought there by sea.

And, finally, there are cases where men have deliberately created a new settlement in a new land simply to avoid any association with some political interest already in existence. The Commonwealth of Australia, in choosing Canberra, on the Molonglo, as the site of its new federal capital in June 1909, made a geographical entity by legislation, in the same way as an administrative division is made by a decree or a treaty.

There are some less conscious and more complex historical phenomena that call for more careful consideration. When conditions are unfavourable to settlement in towns it seems that more intricate requirements and greater use of human force are alone capable of overcoming the difficulty, and then the exception will be a town and not a village, for a smaller effort would not have sufficed.

Thus in the Graisivaudan valley, overwhelmed and swept by the floods of the Isère, human communities have settled on the terraces and cones of dejection; only one community is an exception to this rule, and that is the chief town, Grenoble. So also along the Sarine, deep in a steep-sided canyon from the Thusy bridge to Laupen, there are scarcely any human settlements, the Sarine flowing for the most part between uninhabited banks. There is but one exception—the capital town of Fribourg (first a ford, then a bridge, and finally a *burg*, or borough, set up at the river-crossing).

The opportunities for trade afforded by the frontiers of very dissimilar natural regions have given rise to lines of what are called 'marginal' towns. In the Vosges it was on the boundary-line between the plain and the uplands that the markets of Raon-l'Étape, Senones, Gérardmer, Saulxures, Bussang, etc., were established, where cattle and the produce of mountain industries were exchanged for the grain and wool of the lowlands, and then by a new turn of economic development these markets quite naturally became active little centres of industry.

Besides conditions of situation and strategic considerations, there operate also the needs that arise from man's economic activity and from the chief economic activity of each group. For instance, men who have to spin or weave or dye textiles will settle near clean running water.

It should be distinctly stated here that there are no towns and no roads that bear in themselves the whole of the reasons for their development. As soon as a town or a road comes into existence it enters into certain associations, all of which together hold the secret of its future. The more the phenomenon grows the more dependent is it on its environment, and this environment, whose main constituents are ease and rapidity of communications, is always fashioned or modified to a greater or less extent by the human will.

5. Urban Aggregations and the 'Political' Highway

The Great City and the Large Towns—Brief Notes on an Example of Comparative Geography (the Large Towns of the World above 5000 *Feet)*

The concentration of human habitations generally goes side by side with the concentration of means of communication. The larger the city the closer the network of roads around it, and, conversely, the more the concentration of roads at a given point is favoured by physical conditions the greater are the city's chances and opportunities of growing large.

The essential needs of the inhabitants require for their satisfaction a closely woven network of means of communication. One has only to think, for example, of what is consumed every day by the

members of an urban community of more than four million people, like Paris, and of what must be brought every day to the city markets, to realize how much of the earth's surface is taken up in the outskirts of the city by railways, roads, and streets. The great empires of the world have in all ages been expressed, as it were, in terms of roads, the Chinese as much as the Roman, and the old empire of the Incas like the more modern empire of Napoleon.

Each economic or political centre, whether large or small, is surrounded by a 'star' of radiating highways.

Whenever one of the Great Powers tries to get a foothold in a new area it plans and builds a road or railway. This was the meaning of the Trans-Caspian, the Trans-Siberian, and every other continental 'trans-,' such as the Cape to Cairo route for British expansion. (See Fig. 80.)

Political anarchy is reflected in road anarchy. Thus in Serbia, when I travelled through the natural region of Metokia in 1912, between Pech and Djakovica there were ten or twelve outlines of roads, consisting of various portions or sections which joined up according to the season and the political situation. Before starting you had to find out as accurately as possible which portions of road to use. When a railway is successfully constructed in countries of this kind it can be imagined what a continuous line of rails means from the political point of view.

Regions inhabited by nomads or continually subject to incursions by nomads go along with uncertainty of means of communication. On the boundary-line between an organized zone and one that is not yet organized there naturally appears something else that is connected with attempts at communication, and is the opposite of a road—namely, a *wall*. More than twenty centuries ago the Chinese Empire, to protect itself against the invading Mongols, encircled itself with the Great Wall of China, 2000 miles long, some parts of which were built right up in the mountains at a height of some 6500 feet, the most imposing example that has ever existed of material defence against nomad anarchy.

The town, by its close connexion with the roads, commands them and keeps them in existence. Whereas a mere track can always be very easily altered, every great city, by becoming the terminal point of the highways, fixes them, and thus gives a measure of permanence to the principal routes.

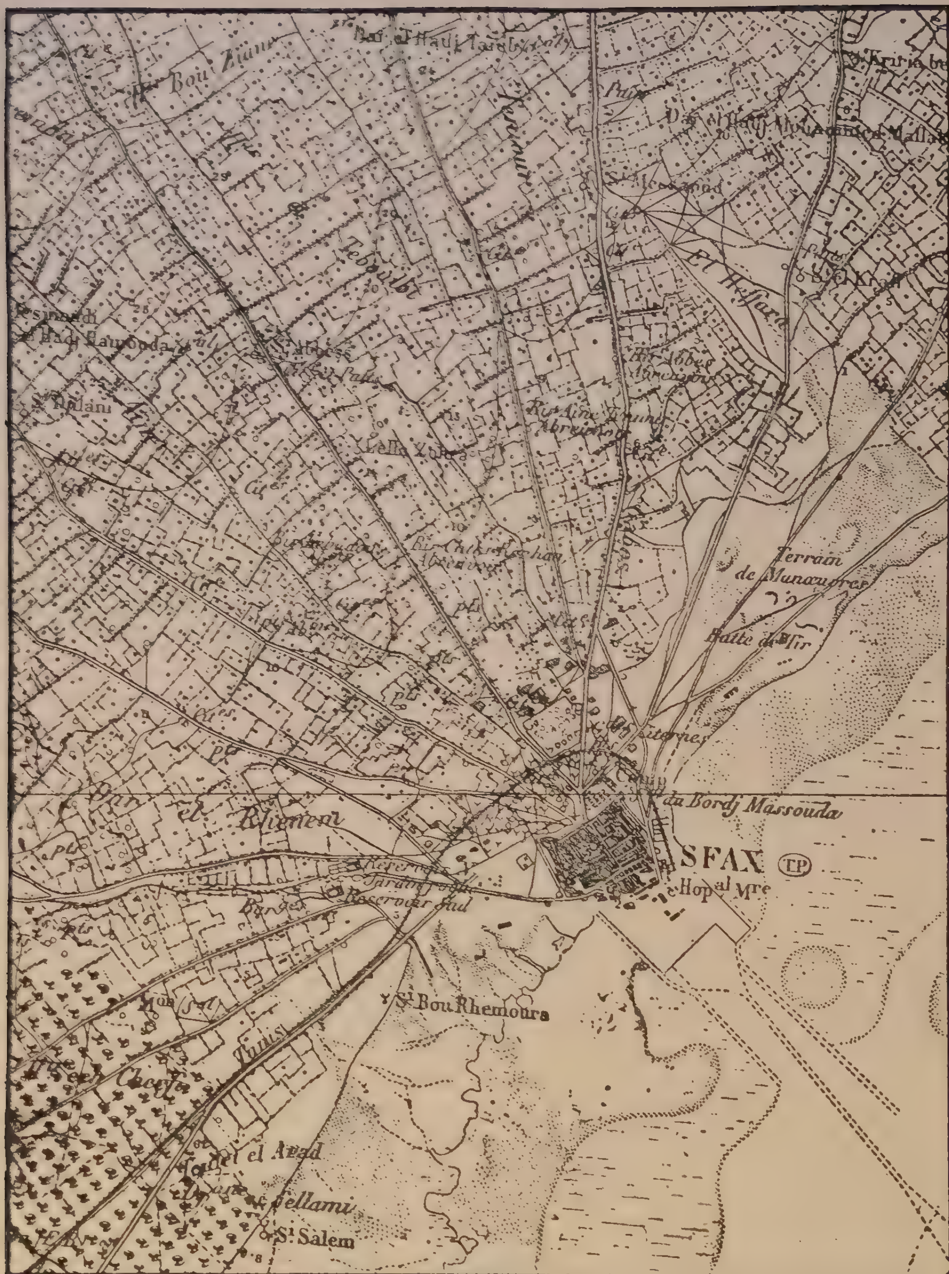
A mountain-pass is obviously marked out for a highway from the beginning by the general conditions of surface relief. But if it is to remain a highway it needs to be safeguarded by the radiating influence of urban centres, exerted at a distance and causing the road to continue to use this naturally favourable route. Such is the case with the traditional Khyber Pass, in the Sulaiman mountains, between the plain of the Indus and the Iranian tablelands, whose two urban terminals are Peshawur and Kabul. The same thing applies also to the pass of Beilan across the Amanus mountains, from Alexandretta at one end to Antioch and Aleppo at the other. (See Fig. 38.)

The road goes towards the urban centre, and is dependent on it, but the built-up centre is dependent also on the road. The town creates the road, but the road in its turn creates the town, or re-creates it, by displacing it or changing its form.

Bergamo was built as a fortress on one of those heights that are the outposts of the Alps on the Lombard plain. The railway and its station were built on this plain, in front of the ancient Bergamo, and the traffic route joins and concentrates around the railway station the new town, which, by its great central avenue and the appearance of its buildings, bids fair to start a new Bergamo at the foot of the old one. (See also the case of Saint-Flour, Diagram XXIII, p. 81.)

Many towns and villages have been influenced in their lay-out by the roads, and by the waterways as well as the highways. (See Fig. 51.)

Villages, representing as they do the minimum effort at human settlement, are even more susceptible than towns to the influence of roads. In many villages and hamlets the houses stand side by side along the highway, giving them that characteristic form that the Germans call *Strassendorf*, or even



MAP XVIII

[*See opposite for legend*]

Gassendorf—'road village' or 'street village.' In our *Géographie humaine de la France* we have described some Normandy villages that show this type in its extreme form, and we have called them 'caterpillar' villages. Thus in the Aliermont district the houses of four villages are strung out, almost without a break, along ten miles of road.

There are other cases besides these where there is no organic connexion between houses or villages on the one hand and roads or other highways on the other. Vidal de la Blaçhe writes in his *Principes de géographie humaine:* "The little hamlets that swarm in the southern part of the Central Massif, the neighbouring but isolated farms of the Rennes basin, and the rural dwellings in the wooded areas are connected with the road system only by lanes made impassable by mud. In the Brie district the distribution of these farms, although they are important centres of rural cultivation, is completely independent of the roads: they are connected only by a network of tracks. In Limagne small-scale farming scarcely leaves room for a few grassy lanes."

In contrast to this, there are many examples of inhabited centres created by roads, and even of those created out of nothing. Among the results of the construction of the St Gotthard tunnel in Ticino was the birth of a village called Lavorgo, while Dazio fell into decay, and the little port of Magadino, farther away at the head of Lake Maggiore, no longer played an important part. So, too, Port Tewfik was built out of nothing at the Red Sea outlet of the Suez Canal, while the ancient town of Suez is dying. And it was the creation of the road from Damascus to Beirut that determined the construction and development of the latter port.

It often happened in old cities that the bridges and the houses were so closely bound up together that the former were themselves covered with buildings. This can still be seen at Struga, on the Drin (see Fig. 45), at Brusa in Asia Minor, at Kreuznach in Prussia, etc., and it was formerly the case also in Old Paris, on the Pont Saint-Michel.

We can, with some justice, therefore, give to these highways, associated with human settlement, the name 'political,' using that word in its etymological sense as a derivative of the Greek πόλις. And, having called attention now to the nature of the almost constant relations between the dwelling and the highway, we must agree that the phrase 'urban aggregation' is itself a concise and compendious term for all connexions of this kind.

The great city calls for study by itself and on its own account as an exceptionally important form of human settlement. A comparative study of the great urban aggregations of Europe has been published by Meuriot, and a number of suggestive studies called *Die Grossstadt* [*The Great City*] have been collected under the direction of the economist Bücher with the collaboration of men of Ratzel's standing. Very detailed studies have been written on cities of the first rank, like Paris and London, whose progressive development has been analysed with very marked attention to geographical conditions. Many observers and writers of great ability have tried to describe the features and most typical characteristics of all the important cities. But not all these studies are equally

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Map XVIII

The Star-shaped Network of Roads round a Centre: Sfax, in Tunisia

Every economic and political centre that is the capital of the surrounding district shows its radiating function by a road network which naturally takes the form of a star if there is nothing to modify its natural regularity, such as the surface relief, the hydrographic system, or the too near neighbourhood of another centre. Sfax is the natural nodal point of all this part of Tunisia, and the simple topographical map is in this case also a kind of photograph of an economic and political fact.

Scale 1 : 50,000.

geographical. Following the example of the village, the hamlet, and the house, the city should be treated as a kind of natural entity to which the comparative methods of the observational sciences can be applied. Ratzel showed in particular the part played by *situation* in the story of a city's development. Oberhummer gave special consideration to the *plan* of the city. Hassert described its entire appearance, arising largely from the pattern of its houses and the skyline of its public buildings—*i.e.*, the *elevation* of its built-up portions. These three essential factors, which combine to make a city a geographical phenomenon, are obviously not the only ones, but they are the principal ones.

That was the position when the second French edition of *La Géographie humaine* appeared in 1912, and since that date *urban geography* has made remarkable strides, and become a kind of independent and very brilliant department of geography, far exceeding all hopes and expectations.

It is the function of urban geography to follow up the preparation of monographs by studies of a more and more general and synthetic character.

In respect of their situation alone, towns may belong, as we have already said, to one or another type. The plans of various towns afford striking proof of this. At the extremities of Lakes Zurich, Lucerne, Thun, and Geneva, astride the streams that issue from them, there lie stretched out in similar situations the four towns bearing the same names. Again, no one who sees three such Mediterranean coast towns as Ventimiglia, Mentone, and Antibes can fail to be struck by their family likeness. Luxembourg, rising above the deep and narrow valley of the Alzette, resembles the Swiss Fribourg, proudly perched on a headland in the canyon of the Sarine, almost as closely as Fribourg resembles Berne (which had the same founder).

When an urban aggregation is restricted in area its houses are higher. In one of the little oases of Ziban, in Southern Algeria, surrounded on all sides by the precious palm-groves that must not be sacrificed, the houses of dried earth rise boldly up to the risky height of two or three stories (Lichana), just as in the Spanish city of Cadiz, encircled by the sea at the end of its peninsula, the houses rise to a great height. So also the houses of Pont-en-Royans have to stand up right above the water owing to the presence of a mere river, the Bourne, which borders the escarpments of Vercors. The same is true of Lyons, Genoa, and Bastia, and the gigantic city of New York, one part of which can extend no farther, holds the record for 'sky-scrapers,' and has many buildings over 600 feet high.

It might be as well to consider especially some of the *organic* factors that are bound up with the very conditions of city life. There are some cities, indeed, which resemble each other in certain actual structural features: Venice, Amsterdam, Danzig, etc., are all built on or near the water, and have the common characteristic of being *cities of canals*, with a complete system of water communications and the kind of life that this entails. They certainly deserve to be grouped together and compared in this respect. They have certain features, original or acquired, connected with certain ways of living, such as daily transport by barges and such industries, fishing in particular, as have to be carried on close to the water.

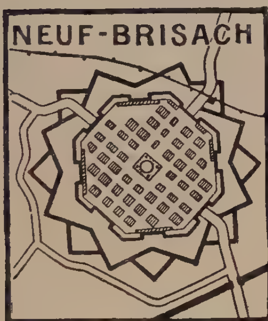
So also in different climatic conditions there are towns with the common characteristic of having been created for the benefit of temporary inhabitants—towns whose needs are very exacting and yet intermittent. Such are the *hotel towns*, like Zermatt, Interlaken, Territet, Mont-Dore, and so forth.

Some towns, owing their origin to the same political ideas and catering for similar tastes and psychological dispositions, show remarkable resemblances to each other.

XIX. Elongated or snake-like town in the channel of a river-valley: Tulle
Similar towns: Épinal, Salins.

XX. Winding town: Mézières-Charleville
Similar towns: Besançon, Montmédy, Montmirail.

XXI. Town surrounded by boulevards, formerly ramparts: Issoire
Similar towns: Beaune, Riom, Montbrison.



XXII. Vauban fortress-town: Neuf-Brisach
Similar towns: Maubeuge, Rocroi, Longwy.

XXIII. Hill-town, with suburb descending into the valley: Saint-Flour
Similar towns: Laon and Vaux-sous-Laon, Séverac-le-Château, Bergamo.

XXIV. Bridge-towns: Tarascon and Beaucaire
Another example is Amboise, with its suburb Bout-des-Ponts.

XXV. Town born of an island: Melun
Other island-towns: the *Cité* of Paris, Saint-Denis.

* DIAGRAMS XIX TO XXV. TOWN PLANS AND SITES

From Jean Brunhes and Pierre Deffontaines, "Géographie humaine de la France," by courtesy of the Société de l'Histoire Nationale *

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Métin clearly grasped and described in his *L'Inde d'aujourd'hui* (pp. 178–180) the similarity in appearance of English towns in India:

"The Englishman never lives in the native city, and even affects to despise it. . . . The English city is almost always at a great distance from the native one, so that one cannot be seen from the other. Avenues and gardens need a great deal of space: thus while Lahore and Madras are almost equal in area to Paris, nine-tenths of that area is occupied by the little British colony, the vast native population being squeezed into a few acres and dwelling in overcrowded houses in the narrow streets of the old city. In the centre of the seaport cities of Bombay and Calcutta is a 'business quarter'—a kind of 'City' like that of London—which is the ancient fort of the East India Company, but which now consists solely of offices occupied only during the day, for when evening comes the English are all in their country homes."

Another modern class or family of towns consists of the great industrial cities, for which coal must be held responsible. This means, however, not that they are built on the coalfields, but that the proper time to study them is after dealing with the geographical facts resulting from the exploitation of this mineral.

The reason for this is that the countries that have no coal and have yet become industrialized have scarcely any acquaintance with the kind of aggregation we are speaking of. In Northern Italy, for instance, the factories are everywhere scattered throughout the open country, in company with the almond- and mulberry-trees and the fields of wheat and maize. And the same is true of Catalonia. This distribution of industrial life is very far removed from that concentration which was the most marked feature of the beginning of the coal age, and remains its most genuine result. It foreshadows what industrial geography will increasingly become as the exclusive domination of coal comes gradually to an end.

Urban phenomena, again, can be grouped also according to other points of resemblance. Thus comparisons can be made between conditions in the great cities of the world situated at a height of over 5000 feet.

Large Towns of the World above 5000 Feet

In the temperate climate of Europe human settlements generally become more and more scattered, and their population less and less dense, as their altitude increases. Ratzel laid stress on this 'rarefaction' at high altitudes, and cited as a typical example the distribution of population in the Erzgebirge arranged in altitudinal zones, as follows:

Height in Feet	Number of Inhabitants	Inhabitants per Square Mile (Approx.)
3,575–3,900	15	10
3,250–3,575	1,507	144
2,925–3,250	6,440	136
2,600–2,925	31,293	114
2,275–2,600	63,291	239
1,950–2,275	138,534	336
1,625–1,950	172,190	320
1,300–1,625	281,362	498
975–1,300	512,346	1,274

In Switzerland, where the average altitude is the highest of any country in Europe, this altimetrical distribution is confirmed. Thus in 1888 only 5 per cent. of the total population lived at a height of over 3250 feet (1000 metres), and even in an entirely mountain canton like Valais only 44 per cent. were above this limit. The canton of Grisons alone, which includes, it is true, the upper valleys of the

Rhine and the Inn (Engadine), has more than half its population above the 1000-metre line, but even in Grisons not a fifth of the human settlements are more than 1500 metres up.

At still higher altitudes, where in our part of the world men find beneath their feet vast snowfields and glaciers and the tourist finds no shelter but a few Alpine Club huts, there are other parts of the globe which support very dense populations and important towns. Whereas in Europe high tablelands have a restrictive effect on human settlement, in other regions it is the lofty plateaux that have become rallying-points for the population.

In Africa there is a huge protuberance called Abyssinia, consisting in large part of eruptive masses, and its principal towns are situated as follows:

Harar,	at a height of		6000	feet
Adowa,	,,	,,	6300	,,
Gondar,	,,	,,	7400	,,
Addis Ababa,	,,	,,	7900	,,
Ankober,	,,	,,	8400	,,

The populated area lies almost entirely between 5800 feet and 8000 feet.

In Yemen one town, Sana, 7000 feet up, is surrounded by orchards of fruit-trees and coffee-growing terraces. Iran has these characteristic features: Teheran, the capital, is 3700 feet up, and has, with the surrounding district, 360,000 inhabitants; Hamadan (the Ecbatana of the ancients) houses 100,000 people at a height of 5800 feet; Ispahan also has a population of 100,000. Kabul, the capital of Afghanistan and one of the keys of India, is nearly 5800 feet up, and has a population of 150,000. Shigatse, in Tibet, is situated at a height of 12,700 feet, while rather lower down is the capital, Lhasa (see Fig. 68), with its monasteries housing 20,000 bonzes at 11,500 feet, a height not reached by any summit in the Pyrenees. Gyangtse is 13,000 feet up, and Phari 14,000 feet. In Southern China Yunnan-fu, the capital of Yunnan province, has upward of 150,000 inhabitants, and stands at a height of 6000 feet.

In the New World there is a strip of land some two thousand miles long, stretching from Mexico to Chile, whose populated area is permanently established in the higher altitudes, almost always above 6500 feet. Mexico City, at 7600 feet, has nearly a million inhabitants, and on the same plateau are a number of towns, such as Leon, San Luis Potosi, Guadalajara, and Puebla, with populations ranging from about 90,000 to 190,000. Bogota, in Colombia, has 420,000 inhabitants and an altitude of 8600 feet, while other towns of less importance, built on the tablelands between 5800 feet and 9800 feet up, have populations of 10,000 to 20,000.

Farther south we reach the inland plateaux of the Andes, where the urban aggregations follow the same upward path:

Quito,	at a height of		9300 feet,	has	120,000	inhabitants
Cuenca,	,,	,,	8300 ,,	,,	45,000	,,

In Peru most of the towns are more than 6500 feet up:

Town	Altitude
Arequipa (pop. 46,000)	7,800 feet
Cuzco (pop. 40,000)	10,000 ,,
Sicuani, 'the Peruvian paradise'	11,500 ,,
Oroya	11,800 ,,
Crucero	11,800 ,,
Puno	12,500 ,,

Finally, Cerro de Pasco, with 25,000 inhabitants, is 14,000 feet up—above the tree-line.

In Bolivia we find:

Town	Population	Altitude
Cochabamba	52,500	8,200 feet
Sucre	27,500	8,800 ,,
La Paz	200,000	12,000 ,,
Oruro	45,000	12,100 ,,
Potosi	36,000	13,000 ,,
Huanchaca, which is growing in importance	—	13,000 ,,

What gives these facts their peculiar value is that these are large and flourishing towns. They are not fleeting phenomena arising from some chance circumstance. The lofty tablelands in question have seen such splendid civilizations as those of the Medes and Persians in Iran, the Aztecs in Mexico, and the Quichua and Aymara civilizations in Bolivia and Peru under the rule of the Incas. And, to make the contrast still more striking, in the countries just mentioned the areas below 5000 feet are generally very sparsely peopled.

What can be the reason for a state of affairs so contrary to what we find in our own European countries? Why has man left the lowlands and abandoned the regions below 5000 feet?

Man has fled from those plains where fever is endemic. In consequence of their equatorial situation and heavy rainfall they have a hothouse temperature—a damp and unwholesome heat that is undoubtedly favourable to vegetation, but almost universally fatal to Europeans, and dangerous even to natives. On the other hand, in Asia and the Malay Archipelago many similar low-lying areas are packed with swarms of human beings.

All the same, however great the influence of climate, it cannot alone explain the peopling of these upper regions, for men must be able to find there the resources they need for life and growth. And that is the case with most of the countries we have just examined: the products of the temperate regions of Europe are found in them, along with those of southern and equatorial regions.

If we ascend the lofty Mexican tableland, at a height where in the Alps, with an Arctic temperature, there is scarcely any vegetation but moss and some scattered herbage, we find fields of barley, wheat, and maize growing to a height of ten to twelve feet, as well as sugar-cane, while palm-trees grow in the Mexican gardens. In Colombia the banana and sugar-cane grow as high up as 6500 feet, and above that there are fields of wheat, barley, and potatoes. Bogota, at 8600 feet, on a plateau where trees are already beginning to suffer from the altitude, is surrounded by extensive areas suitable for stock-raising and cereal cultivation, and it is the same on the high Andean tablelands of Ecuador, Peru, and Bolivia. On the Amazon slopes, owing to their more abundant rainfall, the town of Tarma, at a height of 9900 feet (compare Glärnisch, in the Central Alps, at 9500 feet), grows coffee and sugar-cane; Jauja and Huancayo, at 11,000 feet (the same as the Adula massif, also in the Central Alps), have plentiful crops of fruit and vegetables; while Sicuani, at 11,400 feet (compare Galenstock, 11,700 feet), one of the most favoured and renowned spots in Peru, has fields of maize and many orchards.

In the South China province of Yunnan I was amazed to see all round the capital city, Yunnan-fu, on a lofty plain 6200–6500 feet above sea-level, so many productive fields, and especially so many fine fields of sugar-cane.

But there are some even higher inhabited regions—in Peru and Bolivia. Thus La Paz (population 200,000) and Oruro (population 45,000) are situated at a height of 12,000 feet (compare Mont Dolent, 12,400 feet). Cuzco is 10,400 feet up (the height of the Dent du Midi is 10,700 feet), and has a population of 40,000. Potosi, at 13,000 feet (Bernina, 13,200 feet) has only 36,000 inhabitants to-day, but had more than 100,000 at the time of its great mining activity. And, in conclusion, we might mention Cerro de Pasco, with a population of 25,000 and an altitude of 14,100 feet. The height of the Dent Blanche, in the Valaisian Alps, is 14,200 feet, and there is no peak as high as that in the Bernese Alps. Remember, too, that the height of Mont Blanc is 15,600 feet—only 1500 feet higher than Cerro de Pasco, measured from sea-level.

According to a series of observations made at Cochinoca (11,400 feet), the barometric pressure there was about 19·34 inches. Yet despite this extreme rarity of the atmosphere the Indians of the high plateaux are capable of doing heavy work. Newcomers, on the other hand, are attacked by shortness of breath and palpitation of the heart if they take any violent exercise whatever.

The region of the high Bolivian tableland, or *Altiplanicie*, farther north—*i.e.*, nearer the equator—is strangely barren: "Not a tree, and no fuel. Even at La Paz they use for heating purposes *taquia*, or llama's dung, collected and carefully dried by the Indians. Potatoes alone reach maturity."[1]

These regions, too, are relatively thinly populated:

Bolivia	has	only	6.2	inhabitants	per	square	mile
Peru	,,	,,	13.0	,,	,,	,,	,,
Ecuador	,,	,,	10.4	,,	,,	,,	,,
Colombia	,,	,,	20.8	,,	,,	,,	,,

If we compare these figures with those for certain European or even North American countries, such as the high tablelands of Mexico, for example, we shall have to admit that these Andean republics are relatively uninhabited.

It is certain, on the other hand, that the flood of European emigration does not set towards these high tablelands, in spite of the mineral wealth which may attract the adventurous. In South America the vast plains of Southern Brazil and the Argentine Republic, rich and easily accessible areas, could still take millions of immigrants without any need for them to cross the Andes and settle on the tablelands, where they would be to some extent cut off from the rest of the world, despite the wonderful achievements of modern railway engineering. It is no easy task to conquer mountains with railways, and cross them at heights of 10,000–13,000 feet. Water-shortage has to be taken into account, as well as the special difficulty that confronts all physical labour at such altitudes. But the engineers have done marvels.

The line from Antofagasta to Oruro, in Chilean and Bolivian territory, crosses the Atacama desert, and reaches a height of nearly 13,000 feet. The line Callao–Lima–Oroya–Cerro de Pasco, opened on September 28, 1892, has sixty-three tunnels, and rises in ninety miles to a height of 12,000 feet. Three times it reaches over 13,000 feet, and it even touches 15,500 feet. The line from Arequipa to Puno beats this height-record with 15,535 feet. The new Duran–Quito line reaches 13,300 feet, and the Mollendo–Puno line 14,400 feet. In 1910 a line between Buenos Aires and Valparaiso was completed and opened, the highest point reached being 13,000 feet above sea-level.

Here, as everywhere else, means of communication go hand in hand with urban aggregation. What may be called the paradoxical city is accompanied by the almost equally paradoxical railway-line, which in every case is a remarkable technical achievement. But here actual *roads* are even more

[1] A. Dereims, "Le haut plateau de Bolivie," in *Annales de géographie*, vol. xvi, 1907.

rare than houses, and all further economic development can result only in a multiplication of routes. Now to raise ten tons to a height of 13,000 feet calls for a laborious and costly effort of transport which prevents the growth of very large aggregations at these high altitudes. Man can conquer even very great heights, but he must know the price he has to pay. This much-vaunted conquest of Nature is on the whole only a conditional conquest.

The Most Populous Cities of the World

The demographic statistics of great cities are naturally part of the geographical study of towns. The following simplified tables show approximately what was known of the absolute value of these human aggregations, first at the beginning of 1912 and then in 1939 or thereabouts.

Population of the Largest Cities of the World at the Beginning of 1912 (in Thousands)

London	4,796	Sian (China)	1,000
New York	4,766	Constantinople	943
Paris	2,763	Osaka	996
Chicago	2,185	Hamburg	936
Berlin	2,121	Canton	900
Tokyo	1,819	Budapest	891
Vienna	1,675	Glasgow	860
St Petersburg	1,573	Hankow	778
Philadelphia	1,549	Bombay	776
Calcutta	1,127	Warsaw	756
Moscow	1,092	Liverpool	753
Buenos Aires	1,084		

Population of the Largest Cities of the World where (including Suburbs) it exceeds One Million (in Thousands)

New York (1939)	13,906	Warsaw (1938) (est.)	1,265
London (1939)	8,575	Nagoya (1939)	1,249
Tokyo (1939)	6,581	Los Angeles (1930)	1,238
Paris (1936)	5,130	Mexico (1930)	1,229
Berlin (1939)	4,332	Kyoto (1939)	1,177
Moscow (1939)	4,137	Bombay (1931)	1,161
Shanghai (1931)	3,490	Rome (1940)	1,155
Osaka (1939)	3,394	Barcelona (1934) (est.)	1,148
Chicago (1930)	3,376	Glasgow (1938) (est.)	1,126
Leningrad (1939)	3,191	São Paulo (1936) (est.)	1,120
Buenos Aires (1938) (est.)	2,317	Milan (1936)	1,115
Philadelphia (1930)	1,951	Budapest (1939)	1,115
Vienna (1939)	1,918	Cairo (1927)	1,064
Rio De Janeiro (1936) (est.)	1,711	Madrid (1934) (est.)	1,048
Hamburg (1939)	1,682	Melbourne (1938)	1,035
Detroit (1930)	1,568	Birmingham (1937) (est.)	1,029
Peking (Peiping) (1936)	1,556	Hong Kong (1938)	1,028
Calcutta (1931)	1,485	Nanking (1936)	1,019
Tientsin (1936)	1,292	Kobe (1939)	1,006
Sydney (1938)	1,288	Marseilles (1936)	914

In geographical statistical tables we often find such headings as "Cities of the world with more than 100,000 inhabitants," "Cities with more than 50,000 inhabitants," and so forth.

"If the term 'great city' is applied to a town of more than 100,000 inhabitants," says the economist Karl Bücher, "then in Germany in 1850 one in thirty-eight of the population dwelt in a great city, in 1870 one in twenty, in 1880 one in thirteen, in 1890 one in eight, and in 1900 one in six."[1]

[1] *Die Grossstadt*, p. 4.

This simple specimen quotation shows at the same time the services that can be rendered to demography by purely statistical groupings of this kind, and the arbitrary character of such 'classifications' from the point of view of geographical reality. It is true that naturalists who study and classify living beings do not ignore their dimensions, but dimensions alone are never an adequate criterion for truly scientific classification.

Urban aggregations are formed in most cases from groups of aggregations which have grown larger and gradually approached each other until they have eventually joined. Thus the Paris aggregation really consists of fourteen places with more than 50,000 inhabitants each, whose houses have joined up. Such combined towns are called 'conurbations,' and the notion of conurbation modifies the ordinary statistical classification of cities, for if we set forth the population of such a conurbation as Paris or London in the usual manner we should also join together for statistical purposes the towns of Marseilles, Aix, and Aubagne, whose houses adjoin, as well as Mézières and Charleville (Diagram XX, p. 81), Tarascon and Beaucaire (Diagram XXIV, p. 81), and so forth. A study of the map of Bochum-Essen farther on (Map XXIX, p. 170) will show how industrial belts, which are themselves really urban 'constellations' are likewise marked out on the surface of the earth.

6. Urban Communications and Fortifications

A Physiognomic and Geographical Feature of the City (the Boulevard as a Fact of Urban Geography)

There is assuredly no human fact that has more quickly and completely changed 'the face of the earth' than the recent prodigious growth of cities. A still closer inspection of what has really taken place reveals that it is no mere physiognomic change, but a profound topographical one, which diverts rivers, fills up depressions, levels heights, and so forth. Now, if it is expedient to group together according to their resemblances the material surface phenomena which make up great aggregations, it is equally expedient to study comparatively the parts that make up this whole. The city street has a claim to be treated as a geographical fact, just as much as the road, properly so called. What Ratzel has done for the extra-urban highways that join human aggregations together can be attempted also for the urban highways. The multiplicity, the regularity, and a certain characteristic appearance of the streets correspond in varying degrees to the development of civilization. So also precise differentiation is the mark of progressive evolution: the cross-roads, for example, is a type of urban 'void'—a chance intermediary between the street in the strict sense and the square, or *place*—and one which is tending to disappear.

Next, cities, even the most modern ones, and still more the ancient ones, are lacking in adaptability to the ever-increasing needs of traffic and communications. There is no longer room for the great volume of movement of public and private vehicles, for the streets are too narrow. In the largest cities the problem is almost overwhelming. Just as the house has increased the number of its floors in cities where ground-space is limited, so, too, the traffic routes are tending to be placed one upon another, giving rise to the underground and overhead 'metropolitan' railways, as in New York, London, Paris, Berlin, etc.

A picture of the urban highways, large and small, in a typical town like Genoa, which has had little room to expand, is in the highest degree a geographical one: its wealth of narrow passages between very tall houses, and its variety of names to denote the different kinds, such as the *via*, or street, the *vico*, or lane, the *vico chiuso*, or blind alley, the *salita*, or steeply rising street, the *scaletta*, or staircase lane, the *corso*, or court, and the *mura*, or rampart.

In a great many hill-top towns in Italy, Spain, France, Switzerland, Greece, Algeria, Syria, etc., there are actual staircases, either covered or open to the sky. These are particularly common throughout the entire Mediterranean region, at San Remo and Genoa, at Mostar and Algiers, at Jerusalem and Girgenti. (See Figs. 43 and 44.)

Streets in medieval towns were rarely straight, and the houses rarely aligned. Even to-day there is evidence of this in towns where certain quarters have retained their ancient features, such as Toledo, Cordova, Blois, Morlaix, Bruges, Ghent, Nuremberg, Ratisbon, etc.

As an example we may examine the special features of those highways that are called *boulevards* in most French towns.

The boulevard (English 'avenue,' German *Anlage*, Italian *corso*, Spanish *paseo*, etc.) is an urban highway of more than average width, often planted with trees, and a characteristic feature (*a*) of entirely modern, newly built towns (see particularly the plans of American and Australian towns, of Johannesburg, and even of rather older cities like Berlin, Odessa, and Leningrad) or (*b*) of newly built portions of ancient towns, such as the new quarters of Cairo, Barcelona, Brussels, etc. In the huge aggregations of to-day there is an increasingly felt need to plan and reserve on the monotonous chessboard of intersecting streets some wider highways which become the main traffic arteries.

But though the boulevard is always a recent creation, it may have a more ancient origin, and therefore a richer historic significance and a more interesting geographical appearance. If we glance at a map of Paris we notice the regular and all-embracing circle of boulevards that leads from the Bastille and the ancient gate of Saint-Antoine to the other ancient gates of Saint-Denis and Richelieu. That circle simply marks out a portion of the fortified enclosure that was the Paris of Louis XIV. To-day a continuous line of new boulevards follows the line of the old fortifications.

Now these boulevards are very often the only parts of ancient towns which it has been possible to change easily, and without too much demolition, into wider roads or series of roads—that is to say, the line of the ancient ramparts, which, though demolished, may thus survive in the form of an 'avenue,' modern in appearance, whose lay-out alone bears witness to its historical origin. Taken as a whole, the continued existence of these boulevards in a new form underlines certain essential features of a now vanished past, as in Moscow, Prague, with its *Prikope*, or moat, Vienna, with its *Ring*, Milan, Trent, Bruges, Namur, Cologne, Saragossa, etc. And in France there are plenty of instances of large and small towns with boulevards on the site of the ancient ramparts—Amiens, Rouen, Chartres, Dijon, Auxerre, Montluçon, and so forth. The little town of Brive, and even Beaune and Issoire (see Diagram XXI, p. 81), show this geographical fact in a very distinctive manner.

Fortification is an important characteristic of urban communities, either in the form of walls or in that of trenches that have become canals. Fortification is simply the opposite of the highway system, the geographical expression of the fight against the movement of traffic. Because of the inevitable connexion between town-building and means of communication, an urban centre requires abundance of ways of approach, and to the extent that it benefits from its wealth of roads it is compelled to protect itself against the danger of invasion.

The most rudimentary kinds of surface communications are accompanied by equally rudimentary methods of defence against invasion and straying: pastures, fields, and gardens are enclosed by fences or walls, whose construction and distribution can be studied geographically (see Figs. 71–74), just as the most striking and colossal 'anti-traffic' devices should be studied—for example, the Great Wall of China, the Peruvian wall, and certain shorter walls on the banks of the Dnieper, in Southern Russia, called *Smievy Vali* ('serpent ramparts'), *Veliki Val*, etc. So also it would be very interesting to make a comparative study, geographical, and not merely historical, of the fortifications that surrounded ancient cities, especially those that still exist, whether as dead, half-dead, or living cities—

Aigues-Mortes (Fig. 75), Carcassonne, San Gimignano (Fig. 77), Aleppo and its ancient fortress, Neuf-Brisach (Diagram XXII, p. 81), and many others.

In the same manner a critical geographical examination should be made of the very numerous French castles, each of which, according to its date and purpose, has made use of such natural features as isolated heights, terminal strips of lava streams, the edges of tablelands, the proximity of game-producing forests, marshes, streams, and so forth. Thus, instead of examining existing castles from a historical or an artistic standpoint only, we should seek to discover a strictly geographical co-ordinating principle. What is in any case beyond question is that many towns and villages were born or developed as a consequence of the existence of a castle, under its protection, and sometimes quite literally in its shadow.

Here, again, it is advisable to trace these phenomena of human geography from their embryonic state to their fully developed form: a classification based on dimensions is far less fruitful than an 'organic' one.

In Germany the types that illustrate the various stages in the replacement of ramparts by roads are exceptionally varied. Some towns bear visible signs of their ancient ramparts, which appear in the modern town as a mere ring of wide streets. At Dresden, for example, the old fortified zone is to-day streaked, as it were, by two parallel lines of great highways. Starting from this circular area, there radiate from the centre to the circumference quite straight and wide boulevards of no historical significance, which diverge more and more till they reach the new quarters of the city, the streets having been planned before these new quarters were built, so that the street preceded the houses. It is only rarely, however, that we find on the site of the ramparts an actual street, passing between two rows of houses, as at Dresden. Rather do we find a 'promenade,' known either by that name or as an *Anlage*, though it may happen that the transformed sections of the ramparts have kept the name *Graben* ('ditch' or 'moat'). The promenade is often on a level with the old circular roadway, some ten to fifteen feet above the level of the town which it encircles. At Lübeck and at Stargard, in Pomerania, for instance, the old ramparts have not been demolished, and the *Wallstrassen* ('wall streets') overlook the town. At Göttingen the ramparts form a promenade—a famous 'walk round the town' (Fig. 76). In other cases the ditch of the old fortifications remains more or less intact, as at Ratisbon, Nuremberg, etc. It is accompanied also by a flanking road, either on the town side or the outside, and the general appearance of this kind of boulevard is completed by the walls when these have been preserved, as at Nuremberg. This type is in almost complete conformity with the ancient ramparts themselves, but it has become a boulevard: had there been no modern alteration for the sake of traffic facilities it would have been a rampart and not a boulevard, falling within the realm of military geography alone.

Enough has been said to show the fundamental difference between the two kinds of boulevard—the generally rectilinear and the circular.

Boulevards sometimes bear witness also to one of the distinctive features of ancient historic cities—namely, the pattern of the demolished fortified enclosures and the ancient ramparts. Paris owes her triple ring of boulevards to the precautions and material safeguards forced upon her for so many years by threats of invasion and siege.

At the end of these studies of the unproductive occupation of the soil it was a matter of some interest to show the extent to which fortifications are geographically connected with communications. The former are in general the opposite of the latter, but when they disappear or become transformed they sometimes serve, as in the case of the city boulevard, to assist, to encourage, and to improve the highway system itself.

7. The General Geography of Communications

From all sides and by all these paths we reach once more the general geography of communications, that part of human geography that has so far been the best and most fully treated. It is also the central part of what is called economic geography. For this

twofold reason it is sufficient here to define its scope. Moreover, the analysis of positive facts has led us already to examine the physical characteristics of the street and highway (§ 2), urban aggregations and the political highways (§ 3), and urban communications (§ 6)—all of them matters legitimately covered by the rather vague, but at least very comprehensive, term *Verkehrsgeographie*, or the geography of communications or traffic. No one would be so bold as to claim that all economic facts relating to communications, such as traffic rates, commercial treaties, free ports, etc., can or should be included in the geography of communications, but none the less there is a certain way of approaching the discussion of these complicated problems from a geographical standpoint.

Sea Communications

To deal first with maritime communications, the thing that has characterized them in the past from the geographical point of view, and that still does so despite the growth at the present time of traffic in the Pacific, is the definite predominance of Atlantic commerce. In [illegible] the whole of the mercantile shipping of the world amounted to 24·7 million tons, and [illegible] million of this belonged to the Atlantic Ocean. And thirty years later the proportion was much the same. As early as [illegible] it was possible to declare that "ships and ports are passing through a period of growth of an intensity that exceeds the boldest forecasts and upsets all calculations."[1] This, which was true before 1914, was made enormously more true by the excessive desires, the national ambitions, and the fever of naval construction that marked the 1914–18 War and the post-war period.

On June 30, 1939, the number of merchant vessels of at least 100 tons throughout the world was estimated by Lloyd's Register at 29,763, measuring [illegible] million tons, an increase since [illegible] of nearly a million tons. Steamships of iron and steel, which might be called the solid core of this world fleet, were responsible for 74·3 per cent. of this total, oil-driven ships for 24 per cent. ([illegible] per cent. in 1914), and sailing-ships for only 1·34 per cent.

Tonnage of Iron and Steel Ships of the Principal Merchant Fleets of the World in 1914, 1931, and 1939 (in Thousands of Tons)

	June 1939	*June* 1931	*June* 1914	*Difference between 1914 and 1939*
1. United Kingdom	17,891	20,303	18,877	[illegible]
2. United States	8,909	13,544	1,837	[illegible]
3. Japan	5,629	4,276	1,642	[illegible]
4. Norway	4,833	4,066	1,923	[illegible]
5. Germany	4,482	4,255	5,098	[illegible]
6. Italy	3,424	3,330	1,428	[illegible]
7. British Dominions	3,110	2,398	1,407	[illegible]
8. Holland	2,969	3,118	1,471	[illegible]
9. France	2,933	3,306	1,918	[illegible]

American naval policy had increased the total world tonnage by one-quarter, and created a fleet which accounted for rather more than one-fifth of this total in 1923. This is a fact of overwhelming importance, affecting the life of the whole world, and partly explaining the crisis which prevailed and the great number of ships laid up in the period immediately preceding the War of 1939.

In 1870 Germany had only seven shipbuilding yards; thirty-six years later, in 1906, she had ninety-three. Then followed the 1914–18 War, her defeat, and the peace treaty. But the German fleet recovered the position of which the War had deprived it, and again considerably exceeded the French fleet in 1938.

[1] Louis Fraissaingea, *Le Problème de la marine marchande* (Paris, 1909), p. [illegible].

Japan created a merchant fleet commensurate with the rôle she counted on playing to an increasing extent in the Far East.

The regular shipping lines have been classified by Russell Smith in four groups, as follows:

(i) Fast passenger lines, carrying goods in exceptional cases only, or merely to fill up. Their first and almost their only concern is with speed and regularity. For these lines in particular the North Atlantic was the leading theatre of operations, and it was for them that those giant ships were built—human dwellings, fitted with everything necessary for practical, intellectual, artistic, sporting, and social life.

(ii) Cargo lines, slower but cheaper, of great relative importance in ports which do not aim at supremacy in passenger traffic.

(iii) Shipping lines that are prolongations or extensions of railways. Where a railway ends at the terminal port of many shipping lines the railway company does not think of setting up its own line: "New York has no transatlantic extension of any railway, whereas Philadelphia, Newport News, Pensacola, Portland, and Boston all have them." The Canadian Pacific Railway Company has a line of ships to Great Britain, a line across the Great Lakes, and a very important line from Vancouver to Japan, China, and Hong Kong.

(iv) Private or commercial lines for certain kinds of freight, such as oil, bananas, etc. With regard to the carriage of bananas, Russell Smith notes the importance of the transport companies, which have become owners of plantations and railways and have built hotels to accommodate the travellers whom they carry on their boats, so that there is a considerable group of industries operating round one particular shipping enterprise.[1]

Besides all these regular shipping lines, there is also a multitude of tramp ships which compete with them for freights. These skilful sea-wanderers can accept greatly reduced freight rates, according to their needs and the requirements of their stopping-places. 'Tramping' has been made increasingly flexible by the introduction of wireless telegraphy, which enables ships on the high seas to be diverted and directed to ports where freight is available.

International competition among tramps has reached considerable proportions. As H. Cangardel wrote, in the *Journal de la Marine Marchande* (October 16, 1924, pp. 1059–60): "Tramping is a risky kind of shipping business, extremely interesting to follow in detail, but the chances of loss may be great. . . . The freight market is an Exchange on which freights are traded in like bearer bonds, without the name of the ship being known, so that a cargo may pass from one ship to another in a few minutes, without the owners themselves being advised of these changes, for they have given full powers to the brokers to deal with their ships."

Oceanic traffic has become more and more inter-oceanic: through the joining-up of the oceans it has never ceased growing in amount and intensity. There is no need to repeat here the story of the Suez Canal, the Panama Canal, or the Kiel Canal, but the world-wide growth of sea transport is shown by the fact that ten years after it was opened the Panama Canal was carrying more tonnage annually than the Suez Canal, though traffic through the latter was itself increasing. Suez Canal traffic in 1922, amounting to 20,743,245 tons, beat its own pre-1912 record of 20,275,120 tons. In 1929 it reached 33,466,000 tons, but the economic crisis caused a fall, so that in 1932 it was only 28,340,000 tons. In 1937 it exceeded 36,000,000 tons, having benefited by the transport requirements of the Italo-Abyssinian War, and in 1938 it was 34,500,000 tons (6127 vessels).

The Panama Canal in 1923, its tenth year of existence, recorded a total of 24,737,437 tons, thus exceeding the Suez total, but this lead has not been maintained. In 1932 the figure was 23,000,000 tons, in 1938 more than 27,000,000 tons (5524 vessels), and in 1939 it was 27,866,627 tons (5903 vessels).

The Suez Canal is 100 miles long, and was opened in 1869. The Panama Canal is 50½ miles long, has six 990-ft. locks, and was opened in 1914. The Kiel Canal, 61 miles long, was opened in 1895.

[1] See Russell Smith, "Les transports océaniques," in *Revue économique internationale*, March 15–20, 1911, pp. 446–469.

Continental Communications

In 1940 there were throughout the world 831,000 miles of railways, including 259,000 miles in Europe and 391,000 miles in America, the figure for the United States alone being 256,000 miles, almost as much as for Europe. Continental communications by rail are in process of being electrified.

The continents are crossed by half a dozen railways that may well be called transcontinental, or even inter-continental.

	Length, in Miles
Chelyabinsk to Vladivostok (Trans-Siberian Railway)	4094
Lisbon to Vladivostok, via Paris, Berlin, and Moscow	8469
New York to New Orleans and Los Angeles (Southern Pacific Railway)	3906
New York to San Francisco (Atlantic and Pacific Railway)	3475
New York to St Louis and Los Angeles (Santa Fé and Southern Pacific Railway)	3712
Halifax to Vancouver (Canadian Pacific Railway)	3768
Brisbane to Melbourne (Australian Coast Railway)	3500

These principal lines, therefore, range in length from 3500 to 4000 miles. When a line is built from the Cape to Cairo it will extend for 6000 miles. The Trans-African Railway, from Lobito Bay, in Angola, to Beira, in Mozambique, is 2250 miles in length, or, with the branch to Johannesburg, 2970 miles. The Orient Express, from Paris to Bucharest, covers 1978 miles, and the Simplon Orient Express, from Paris to Istanbul, 1892 miles. The Trans-Andine Railway, from Buenos Aires to Valparaiso, is 887 miles long, and the Trans-Iranian, opened in 1939, is 875 miles. The Haidar Pasha Railway, from opposite Istanbul to Bagdad and Basra, will be 1520 miles long.

It is clearly impossible to measure the length of the inland waterways—the navigable parts of the great rivers—as accurately as the railways, or to compare the useful human part played by these great natural arteries. But it is possible to be more precise at all events about the artificial waterways—the canals. Of great importance, too, because of the revival of the roads which it has brought about, as well as for its social results, is the motor-car, which competes and collaborates with the railway, and is in process of revolutionizing the transport system.

Before 1914 there were not two million cars in the whole world; twenty-five years later, in 1938, there were forty million. Of this total, two-thirds were in the United States, whose 130,000,000 people owned no fewer than 28,520,000 cars. Great Britain and Canada had 1,843,000 and 1,120,000 respectively, and France more than either—1,940,000. The total length of the roads of the world approaches ten million miles.

Air Transport

The course of events since 1914 has greatly increased the numbers and accelerated the progress of that recent invention the aeroplane, which is now used in every continent for regular transport services.

*Between 1918 and 1939 the approximate length of the world's air routes increased more than a hundredfold (from 3220 miles to 335,448 miles), and the mileage flown was 200 times as great, increasing from 938 million miles to 200,000 million. All the regular air routes are marked on the earth's surface by the various kinds of equipment they require—airports, beacons, lighthouses, fuelling stations, and so forth. Air routes, though more independent of natural obstacles than surface routes, are none the less compelled to take into account the distribution of land and water and such things as deserts and mountains. They are influenced also by many geographical phenomena, and above all by atmospheric conditions connected with both general and local geography. Valleys are not only useful landmarks for airmen, but in most cases they are favourable to air navigation as well.

Flying over forests, on the other hand, causes trouble from eddies and air-pockets. Whereas the lofty barrier of the Alps is relatively easily crossed, planes have to avoid and bypass the Central Massif, though its height is much less, because for a great part of the year it is covered by a dangerous bank of fog. The atmospheric currents prevalent over the North Atlantic, expecially from east to west, retarded for a long time the establishment of a regular air line on this part of the Atlantic, but technical progress in such things as increased engine-power, wireless direction-finding, and so forth, has made flying more independent of the primary atmospheric and geographical conditions which once restricted it. This was shown by the inauguration in 1939 of regular services over the North Atlantic, though they had started several years earlier in the southern part of that ocean. Other geographical factors, more complex and more 'human,' have thus become the most influential ones in the establishment of these lines: their creation is accounted for by the need felt by regions of dense and active population to make speedier contact with each other.

Transport facilities and greater speed of travel change the face of the earth by changing relations between distances, and have in practice "given the countries of the world, as it were, a new shape and new outlines."[1] When we can reach the Cape from London in 39 hours 25 minutes—the record flight in February, 1939—it is as if South Africa had suddenly come nearer to England. From these considerations it follows that the geographical position of certain places gains in importance, while that of others loses.

Domination of the earth and domination of the air are to-day inseparable, and the International Convention of 1919 recognized the complete and exclusive sovereignty of states over the air above their territories. Hence has arisen a new situation: space is being organized, new legislation is being formulated, and a system of 'air law' is being worked out. Nowadays a state is no longer simply a piece of humanity, of land, and of water (see p. 40), but 'a piece of air' as well.*

Rapid Communication of Thought

There are two million miles of overland telegraph-lines in the world, the best-provided countries being the United States, Germany, France, Soviet Russia, Great Britain, British India, Australia, Canada, and the Argentine. There are also telephone systems, in which the countries best equipped are the United States, Germany, England, Canada, Sweden, France, and Japan, and submarine cables, of which Great Britain and Ireland possess rather more than half (203,750 miles out of 383,500 miles), the United States a quarter (87,500 miles), and France a tenth (41,250 miles). To these means of communication have now been added, as auxiliaries or rivals, wireless telephony and—still more important—wireless telegraphy or radio-telegraphy. The civilized part of the earth is being covered with pylons for transmission and reception, and in the most favoured countries each inhabitant has a receiving-set that keeps him in constant touch with a world of non-material communication.

Telegraphy by wire has to face the competition of wireless: thus in French Indo-China, where in 1921 all telegraphy was by wire, in 1930 only 17·3 per cent. was of this kind, the remaining 82·7 per cent. being wireless. But this competition has stimulated the development of long-distance telephony by wire. Television, too, has made rapid progress. From every point of view—economic, political, and intellectual—this rapid communication of thought has worked a veritable revolution in relations between men, between groups of men, and between states.

General and Regional Communications

G. A. Hückel has summarized and co-ordinated a considerable part of Ratzel's strictly geographical theories on the general geography of communications, in two articles in the *Annales de géographie* (vol. xv, 1906, pp. 401–418, and vol. xvi, 1907, pp. 1–14).

Modern progress in ways and means of communication has determined the following things:

(i) The multiplication of roads.
(ii) An increase in their length, as a result of the great discoveries.

[1] *La Géographie de l'Histoire*, p. 12.

(iii) Their reduction to the shortest lines.
(iv) The substitution of natural regions for regions and places chosen by chance.
(v) An increase in the extent of space conquered, and in the capacity for mass transport.
(vi) The carriage of much continental traffic by way of rivers and seas, and the construction for river traffic of artificial transverse waterways or canals from one river-basin to another.

Ratzel compares this general development of communications to the development of a river system. Corresponding to the old age of a hydrographic system is the decay of the communication system, either by the destructive disruption of the small arteries after the exhaustion of the main artery or when, on the other hand, the local circulation grows weaker and ceases to feed the main arteries in consequence of a slow decrease in the population. The entire system, or group of systems, of economic circulation is as harmonious as a hydrographic system, owing to the influence on its various parts of changes of fortune in the whole. An acceleration of movement in the central artery accelerates movement in all the circulatory routes attached to it. Thus the construction of the Suez Canal led to the revival of navigation in the Mediterranean and the Red Sea, the creation and improvement of railway-lines crossing the Alps, the piercing of the St Gotthard tunnel, the employment of more powerful engines, and a general speeding-up on all the railway systems of Europe north of the Alps.

But the unquestioned superiority of the new transport methods lies not so much in increased speed as in the total weight that can be carried by a given transport unit. The following table gives a rough comparison of the ways in which heavy goods can be transported, and explains the unprecedented power of modern transport methods:

Approximate Weights that can be transported by Various Methods, by Land and Sea

Large transatlantic cargo steamship	20,000 tons (= 2000 small 10-ton goods wagons)
Ordinary steamship	5000–6000 tons
Large sailing-ship	3000–5000 tons
Rhine boat	3000 tons
Goods wagon	10, 12½, or 15 tons
Multi-engined aeroplane	5–6 tons
Motor-lorry	2½–5 tons
Single-engined aeroplane	1½ tons
Horse *draws*	1 ton (= 2200 lb.)
Elephant *carries*	880 lb.
Camel *carries*	440 lb.
Horse or mule *carries*	330 lb.
Rickshaw man *draws*	220 lb.
Ass *draws*	165–220 lb.
Eskimo sledge-dog *draws*	100 lb.
African or Asiatic porter *carries*	55–65 lb.
Ass (in India) *draws*	55 lb.
Sheep or goat (in Himalayas) *carries*	25–35 lb.

Of the two transport animals of America, the Eskimo dog in the far north and the llama in South America, the former can *draw* 100 lb. and the latter can *carry* 65 lb. According to these figures, it would require about 10 horses to *draw* the weight carried by a 10-ton goods wagon, and to *carry* the same weight would need 50 camels, 60 horses, 100 asses, or 330 men.

Any geographical account of communications will have to describe in greater or less detail the *surface picture* that results from traffic and transport on the earth.

It will depict the areas and places on the earth's surface that are chosen for traffic purposes, and will show whether they are large or small, general or regional, and the population needed as means and agents of transport (see Figs. 79–86). It will give all the importance they deserve to the

characteristics of modern communications in different regions, and will devote *new* attention, so to speak, to ancient and traditional features of minor means of communication in these regions.

It will have also to perceive, as it were, the reality of bigger things than the physical eye can see in their entirety, such as the close-packed cluster of maritime trade-routes in the North Atlantic or the Mediterranean, and those points on the earth's surface where all these more or less divergent lines at length converge until they join and become fused together, to end in a great seaport or to cross narrow and essential zones like those called landing-areas.

Furthermore, all facts concerned with communications should be considered in and for themselves, just as facts connected with human settlements have been. Many of them are localized, and, after having defined the formal and physiognomic type, it will be advisable to determine (*a*) their situation (areas of extension), (*b*) their dispersal or concentration, (*c*) their special limits.

Vidal de la Blache, in Plate VI of his *Principes de Géographie humaine*, has depicted some interesting limits in the use of sledges, birch-bark canoes, outrigger boats, etc. But these limits are by no means fixed. Sometimes they change much more quickly than might be imagined, under the determining influence of newly introduced ways and means of transport. So, too, a new method may spread very quickly over a fairly large area. Japan is the native land of the rickshaw, which originated there in 1869 precisely, but it has spread since that date throughout China as far as the border towns of Mongolia, and even of Chinese Turkestan, through the whole of French Indo-China, into the Dutch East Indies, India, and Ceylon, and even into South Africa.

It would be particularly interesting to consider the very skilful way in which some of these exceptional kinds of transport devices have been adapted to geographical conditions, such as the birch-bark canoe of the forest regions of North America; the sealskin kayak of the Eskimo, a light and slender craft that is as much one with its navigator as a horse with its rider; the outrigger piragua or pirogue; and the wheeled cart or carriage. (See Fig. 85 and Map XXXIII.) This latter, a marvellous transport instrument, was formerly known only in Southern Asia, from China to Asia Minor, and around the Mediterranean. It reduced friction by substituting the resistance of rolling for the much greater resistance of sliding. Even the Chinese wheelbarrow has played a part of capital importance in economic history. (See Fig. 86.)

An examination might well be made of all the ingenious devices invented by men for carrying things on their backs, such as the basket, the Annamite balance called a *gâhn*, and so forth, as well as with the aid of animals. (See Figs. 44, 83, and 84.) It should be noted, for instance, that it is the same with hollow tree-trunk canoes as with primitive wooden houses: so natural are they that they are both found in almost identical forms in surroundings far removed from each other and in very different climates. Yet on closer examination very many varieties can be distinguished, which may correspond to very different ways of living. Thus to make a piragua forty, fifty, or even only thirty feet long by hollowing a tree-trunk calls for an advanced technique involving considerable experience both of navigation and of working in wood.

There are some peculiar features of methods of communication arising from the means that are employed.

A line of rails is definitely fixed, and the train is confined to a fixed journey and fixed stations and must discharge or transfer its load at fixed stopping-places—a revolutionary change from ancient transport methods, which were more primitive, but also more flexible. The camel is slow on the march, but can be led right up to the hut or tent or bazaar of the man whose produce has to be transported. It is facts of this order that explain the not unreasonable resistance of certain communities to progress in locomotion. When I visited Lebanon in 1899 I was told that for many years a camel caravan company had held up the railway from Beirut to Damascus and seized a great deal

of the traffic. To-day, on the other hand, the regular motor-car services across the desert offer serious competition to the caravans. This necessary connexion between the ways of communication and the means of transport used has had numerous repercussions. Thus it has been necessary to make many roads for the use of motor traffic, and this has brought about an improvement in communications in general.

Inland waterway and railway systems have also their zones of maximum density and their limits, and to determine these must always be one of the tasks of the geographer.

There are both *latitude* and *altitude* limits for railways. For instance, the most northerly line in the world is the Russian line from Leningrad to Murmansk, on the Kola Peninsula, which reaches atitude 69° N. The most southerly railway system is that of New Zealand. The maximum altitude limits are reached in South America. (See the figures for towns over 5000 feet up, at the end of § 5.) Maximum altitudes in Switzerland are reached by the rack-railways now in operation, with terminal stations at Gornergrat, 10,000 feet, and Jungfraujoch (only a temporary terminus of the Jungfrau railway), 11,200 feet. The highest altitudes in North America are reached by the Denver–Rio Grande railway, at 11,200 feet, the Pike's Peak railway, at 13,300 feet, and Moffat Road, 11,500 feet.

It is of particular importance to observe the distribution of the areas in which products originate, the areas to which they eventually go, and the transit areas.

"*Transit Regions and Entrepôt Countries.* Peoples that are most backward in methods of trade give merchants good opportunities for doing business. Some peoples have acquired trade privileges or monopolies, while others have restricted themselves to the rôle of intermediaries or brokers. Here, then, we find the transit area, and in some cases the whole country acts as a market. In the countries to which Ratzel gives the striking name *Stapelländer*—staple lands, or entrepôt lands (formerly 'staples')—the inhabitants stay where they are to receive foreign products and convey them no farther than from one frontier to another. Thus arose a definite series of intermediate trading areas. In the Middle Ages Arabia, Armenia, Persia, Greece, Italy, France, Flanders (Bruges), and Northern Germany all acted as transit areas. Each new development meant that an intermediary which had become superfluous was eliminated. This spelt ruin for a trading city or state—for example, the Hanse towns, Flanders, and Venice (though these revived, at least as maritime Powers), the Sabeans, the Bulgarians, and the Armenians. In ancient times the relatively enormous distances between centres of civilization favoured a multiplicity of such transit regions—for example, Arabia and Asia Minor. The Semites and the Greeks were always great commercial intermediaries, as were the Italian republics in the Middle Ages."[1]

It would almost be possible to divide the world into regions according to their resemblances and differences in ways and means of transport. Actually, however, each of the great divisions of the earth has its own pattern in this respect. In each part of the world there are what might be called specially favoured areas which seem to have distinctive features in the matter of communications, owing either to their physical situation, to their structure, or to what man has made of them.

To give a general view of what Ratzel called "the œcumeny of communications" and of transport methods throughout the world, A. Hettner published an essay in 1894 in the journal of the Berlin Geographical Society, with a very interesting map. From the regional point of view we know of no better example of the method to be followed than H. Baulig's article (*Annales de géographie*, vol. xvii, 1908, pp. 433–459) on the distribution of modes of transport and communications among the natives of North America. This article is the more noteworthy because it is primarily an explanation and commentary on a map,[2] which will be found on close examination to sum up in itself not only the

[1] G. A. Hückel, *Annales de géographie*, vol. xv, 1906, p. 413.
[2] Reproduced in *La Géographie humaine* (third and fourth French editions), p. 275.

problem, but the principles of general methodology which it was advisable to formulate in connexion with the various features of the unproductive occupation of the soil.

The Relation of Communications to Production and Population

Communications depend on production and population, and therefore in some cases serve to measure them. And they tend to do so more and more. The vital organs of world communications are, as it were, a registering apparatus indicating the health or sickness of production, or, rather, its progressive transformations.

In the Suez Canal we may be said to feel the pulse of productive vitality over an area extending from the Far East to the Far West. The fluctuations of Canal traffic reflect not only the world economic crisis, but also the changing appearance of importing and exporting countries making use of this highway for their trade.

But it is obvious that production is quickened and organized in the areas where it takes place, and sometimes even created, simply by the prospect of possible exportation, and therefore of communications.

Whereas the whole of Great Britain's trade represents only 40·7 lb. per head of the population, and Canada and Australia are not much in advance of the Mother Country with 41·4 and 44·9 lb. respectively, the trade of New Zealand is 62·1 lb. per head.[1] New Zealand sends Great Britain more frozen mutton and lamb than the Argentine or Australia; more sheepskins than Australia or South Africa; more animal fats than Australia, the Argentine, Uruguay, or the United States; more cheese than the Netherlands; and more butter fat (the equivalent of butter and cheese) than Denmark, Australia, or Canada. She comes after Australia for wool, and after Denmark, but before Australia, for butter. These facts merit consideration; they explain why the New Zealanders like to name their country 'the brighter Britain of the South.'

Again, internal communications are rarely proportional to external ones. In many cases it is evident that the latter are dominated by the former, but the relations between them are subject to peculiar fluctuations and changes of fortune.

If we compare internal and external trade we find striking differences between new countries and those old ones where each district has for long centuries had to strive after self-sufficiency by producing everything it needed for itself. In young or new countries, on the contrary, large-scale specialization in cultivation and in all kinds of production is the rule. In the United States, for example, there are entire regions aptly termed the cotton belt or the corn belt. This gives marked power and vigour to the very necessary trade between the different regions, so that internal or inter-state trade is much greater than foreign trade, to a larger extent than in our European states.

And so, having started from simple material things, capable of being seen and photographed, like houses and roads, which combine to form urban aggregations, large and small, and having patiently traced their varieties, their development, and the more complex phenomena of which they are the expression, we have risen step by step to considerations relating to the deepest problems of geography, economic, social, and, in a sense, political also. If we trace this guiding thread through this third chapter we shall undoubtedly realize the value of this clear method of positive observation:

1. Kinds of houses. 2. Physical characteristics of the street and the highway. 3. Villages and their types. 4. Localization, dispersion, concentration, and limits of human settlements (houses and roads). 5. Urban aggregations and great cities. 6. Urban communications and the boulevard. 7. General geography of communications.

[1] These figures are for the year 1922–23.

Each of the chapters dealing with 'essential facts' should therefore expand into a kind of super-chapter, conducting us to the threshold of 'the geography of history.'

A few concluding thoughts of still wider scope will serve to link up this chapter with those that follow.

The factors that create traffic and transport are all the characteristic forms of creative or destructive economy and the compulsory migrations that result from them (see Chapters IV and V), and the chief of these is trade, whose aim is to put raw materials and manufactured products in the places where they are wanted or where they are useful.

Men have not physiological wants and desires alone; they have not only stomachs. Human communities have other needs as well, and account must be taken particularly of the need for labour, which explains so many human migrations and settlements (see Chapter IV). Many currents of definite immigration and much of the periodical ebb and flow of migration are determined and directed by demands for labour.

The more civilization takes on an economic character the more do the political and the economic intermingle. So also the more the means of communication are increased and improved the more do the facts of human transplantation, which are bound up with all intensive exploitation of the earth, become first numerous and then varied.

In the United States the cotton industry has moved from south to north in search of cheaper labour, which means Negro labour. In 1923 the number of spindles in the southern states was 78 per cent. of the total number in the north, but not only was the proportion of spindles at work in the south greater than that in the north, but the southern ones did so much more work that the number of spindle-hours was one-sixth greater in the south than in the north. Thus it is no longer only labour that is attracted to a certain industry: industry itself may be attracted to other places by the quantity or quality of labour. While these economic phenomena were in progress the Negroes in the south, attracted into industrial activity by the war-time industries, spread farther and farther north, to become industrial workers there, and in the cotton states of the south, to which the cotton industry was drawing nearer, the coloured labour that had been attracted to it diminished. The cotton-fields themselves suffered by this reduction in the amount of rural labour, especially in such years as 1923, when vast areas planted with cotton were attacked by weeds. According to statistics compiled by the Association of Bankers in Georgia, 229,000 Negroes had emigrated northward from that state in three and a half years.

Communications are not only a factor in the physical transformation of the surface: they transform also the quantity, the quality, and the aptitudes of the human population.

As a comprehensive result of all their ever-growing needs and their early endeavours at exploitation and trade, men are of necessity inclined, and even encouraged, to conquer space—space that is free, and especially space that is peopled by human beings. Whether or not this is a desirable thing, they acquire to an increasing extent the spirit of conquest, and in that sense communications become what Ratzel calls "the vanquishers of space." But this conception is incomplete, for the political and the economic join hands to set a high value on man himself, on labour, and on human settlement. No true power results from space alone—empty space—for space derives its fundamental value only from its connexion with life. And so it is that the progress of communications always takes the form of a more or less conscious recrudescence—whether cynical or disguised—of the spirit of domination.

Chapter IV

ESSENTIAL FACTS OF HUMAN GEOGRAPHY

SECOND GROUP: CONQUEST OF THE PLANT AND ANIMAL WORLDS—CULTIVATION AND STOCK-RAISING

1. Geography of Plants and Animals in relation to Primary Climatic Factors

From a geographical point of view the geography of plants is even more important than that of animals, for plants do not move. They also form the really basic part of human food. So the distribution of plant cultivation is capable of being geographically analysed to an even more striking extent than the distribution of domestic animals.

Plants are small organic units which show the decisive effects of the surroundings in which they live. In earlier classifications plant geographers attached too much importance to climate alone, and even to certain factors of climate only. This idea has been replaced by a far truer and more accurate one—the idea of *environment*, as we said in Chapter I. The ideal state of affairs for a plant would be for the climate, the soil, and the biological environment at each stage of its development to correspond to the progressive requirements of its life and constitution: this is the concept of the *biological optimum*. But no theoretical analysis can determine in advance the way in which a plant will behave in a given soil.

Some soils are rich in the salts that the plant needs, but they may be in an insoluble form and incapable of being assimilated, in which case the plant is in the same position as if they did not exist. Some plants, on the other hand, seem to demand soils rich in mineral salts like sodium chloride, calcium carbonate, etc., and are therefore called *halophils* or *halophytes*, *calcicoles*, etc. But this simply means that their constitutions are such that they can stand doses of these salts which would be harmful or even fatal to other species. The Belgian agricultural scientist Proost has shown, both by theory and by many experiments, the value of what he calls "the analysis of soil by the plant."

There are some parts of the earth where the rainfall is plentiful—like New Zealand and some of the small islands on the coasts of Brittany and Frisia—but where the prevailing strong winds cause so much evaporation that plants receiving as much as 80 or even 120 inches of rain annually are compelled to protect themselves against evaporation, just as if they lived in a desert region. On the west coast of Greenland there are plants that counteract evaporation in the same way as in the heart of the Sahara and often have the same physiognomic appearance.

In our part of the world precipitation occurs in the winter, but in such a form and of such a temperature that plants can benefit by it. That is why the organs of respiration and transpiration disappear: the trees lose their leaves. This means that plants suited to a moist climate during one period of the year (called *hydrophilous* plants) become, as it were, different plants for the rest of the year: they become *xerophilous*—plants made for dry conditions. And these changing plants are called *tropophytes*.

Lastly, the soil is of value to plants only when it goes hand in hand with climate, and climate only when it suits the soil. The same kinds of limestone soil may be unfavourable to certain species of plants in moist regions, but very favourable to the same plants in such regions as the Mediterranean.

What has to be considered, then, is the entire assemblage of natural conditions in all the many delicate and almost imperceptible combinations of these different factors that go to make up environment, and plants can be regarded as labels indicating this assemblage.

And as we reach this fundamental concept of environment we cannot insist too strongly on the importance of the *human* environment—its density and its quality from the point of view of cultivation. Cultivated plants are quite as dependent on the number of men and the strength and efficiency of their muscles as on climate and soil. These factors have been too often overlooked, not only in strictly agronomic studies, but even in economic ones, and it is definitely part of the business of human geography, as we shall see, to deal clearly and unceasingly with this factor—*labour*, or *man-power*.

But the geography of cultivated plants and domestic animals is none the less, in its broad outlines, connected with general climatic geography, and the principal forms of cultivation and stock-raising cannot be located without distinguishing the chief climatic regions of the earth. Among the natural classifications of climates there is one that demands our attention—that of Köppen. Climate is an exceedingly complex thing, so if we consider temperature, pressure, and rainfall alone and separately we run the risk of ignoring the actual synthesis that results from the combination of these different factors and their reactions on each other. A plant, on the contrary, which is part of the natural vegetation of a region and compelled to submit to all the complex influences of these climatic factors as a whole, is a recording instrument which, if well chosen, can illustrate to a very high degree the cumulative effects of differing climatic phenomena. Such is the nature of cultivated plants, requiring optimum conditions to achieve maximum production, that Köppen has on more than one occasion selected one of them as the distinguishing label for a climatic zone that he wished to characterize and mark off from others.

The Principal Climatic Attributes of the World. Three Kinds of Vegetation of Similar Appearance, and Two Kinds of Desert

It will be as well to make a still more comprehensive attempt to describe the general distribution of climates on the surface of the globe. This is not in any way to deny the extreme importance either of regional studies of climate or of a more or less detailed analytical examination of natural regions as well as of the smaller regions within each of these larger ones. But when we look at the earth as a whole we find certain salient features definitely marked out on the ground by its plant covering.

We can start with the old traditional and almost childish division of the earth into five zones, as follows:

I. North frigid zone.
II. North temperate zone.
III. Torrid zone.
IV. South temperate zone.
V. South frigid zone.

Now, if we introduce into this traditional division the factor of *humidity* its general appearance at once gets nearer to reality. Thus the torrid zone will be divided into *hot and wet* zones and *hot and dry* zones, alternate and contrasting. Between these two very dissimilar types are intermediate or transitional zones where the other two gradually shade into each other—and these are the most important zones from the human point of view. So, too, the northern and southern cold zones can be divided into *cold and wet*, where precipitation is plentiful enough to permit the growth of forests and where for at least four months of the year the average temperature is above 50° F., so that vegetable growth is possible, and *cold and dry*, where precipitation is rare and inadequate, as on the Russian *tundra*, and also in all areas where the temperature is always so low that neither shrubs nor trees can grow.

Between the cold northern zones and the hot equatorial or tropical zones are **transitional** zones, corresponding to what were formerly and far too vaguely called *temperate* zones.

I. Northern cold zones { (*a*) cold and dry. (*b*) cold and wet.

II. **Transitional** or temperate zones (Mediterranean, Atlantic, etc.).

III. Hot zones { (*a*) hot and dry. (*b*) **transitional.** (*c*) hot and wet. (*d*) **transitional.** (*e*) hot and dry.

IV. Southern **transitional** zone, corresponding to the Mediterranean zones in the Northern Hemisphere.

V. Southern cold zones { (*a*) cold and wet. (*b*) cold and dry.

Now, speaking of **transitional** zones is the same as speaking of **human** zones, or at all events of zones favourable to human settlement.

In relation to the Europe-Africa continent this new theoretical division into climatic zones corresponds to the following natural regions:

I. Northern cold zones	(*a*) cold and dry	Lapland.
	(*b*) cold and wet	Scandinavian forest and Russia.
II. Series of northern **transitional** or temperate zones		**Atlantic coasts of Europe, Mediterranean area,** etc.
III. Hot zones	(*a*) hot and dry	Sahara.
	(*b*) **transitional**	**Sudan.**
	(*c*) hot and wet	Congo forest.
	(*d*) **transitional**	**Upper Zambesi, upper Congo.**
	(*e*) hot and dry	Kalahari.
IV. Southern **transitional** zone		**Coasts of South Africa.**
V. Southern cold zones	(*a*) cold and wet	(Ocean).
	(*b*) cold and dry	

It is evident that the **transitional** zones (printed here in **heavy type**) are the areas of maximum human activity so far as Europe and Africa are concerned.

The distribution of climatic zones in Asia and America is rather different from that of Europe and Africa.

In Asia the successive zones are, in general, shifted northward, owing to the extreme heating of masses of air in the Tibet region, the consequent power of attraction of this heating from April to October, and the whole group of centripetal air currents which make up the rainy summer monsoon. In America the general trend of the relief of the country is north and south, and the climatic zones have a somewhat slanting appearance in relation to parallels and meridians alike.

There are certain undefined varieties and variations which call for the most careful attention in any regional study, but not so as to conceal essential geographical truths.

Thus there are two types of forest: the **equatorial forest** of the hot and wet zone, and the **northern forest** of the cold and wet zone. So also there are two types of desert: the **hot or cold deserts** lying between latitudes 50° N. and 45° S., on either side of the equator (deserts where the summer months are always hot), and the **perpetually frozen deserts**—the tundra and the permanent snowfields. Lastly, on the edge of the first kind of deserts there are the **steppes,** with a definite winter season and a hot summer, varying in dryness and humidity, and covered to a very large extent by such kinds of plants, bushes, and low shrubs as are more or less adapted to drought and moisture.

Such, then, are the five most general and obvious climatic attributes of the earth, in the sense that they are found in all the continents, that they are the most strongly contrasting types, and that they clothe the greatest areas with a covering which, if not uniform, is at least similar, and generally very homogeneous in appearance. And it seems to us that these five zones, marked by what we have called the five climatic attributes, possess one feature in common—namely, that on various grounds, and in proportions that vary and that can be altered, they are naturally unfavourable to human settlement: nowhere do they contain a very dense population.

The **transitional** zones, on the other hand, represented by more complex types of vegetation, are the inhabited lands, the lands of vigorous civilizations, whether old or young—what may be described in one word as **human lands.** They include countries with tropical summer rainfall like India, China, and the Sudan; countries of winter rain like the Mediterranean lands, the southern part of Africa, the south-east of Australia, and California; the eastern states of the U.S.A., where the violent climatic contrasts of the southern and central plains of North America are toned down; mild and damp countries with no wide range of temperatures, like all that part of Europe that benefits by the influence of the Atlantic; and so forth.

Having thus drawn the framework in broad outline, we can usefully proceed to fill it in with various kinds of shading.

2. Origin, Importance, and Number of Cultivated Plants and Domesticated Animals

*Various Forms of Cultivation and Stock-raising—*Agrarian Geography and the Rural Landscape**

There are still some plants of first-rate importance, such as wheat and the common bean, whose original home cannot be determined with any precision. These things go back so far that they belong to the oldest story of man's earliest efforts to draw from the earth the food that he requires. Most of the great plant crops are far older than the earliest Egyptian or Chinese dynasties. Man's ancient power of selection and domestication, which is undoubtedly one of the faculties with which the human spirit has been endowed, seems to-day to have become exhausted, for despite the progress of so much scientific method the list of new cultivated plants is remarkably short. If we seek to discover what crops have been introduced during the last two thousand years all we shall find is a few artificial fodder crops, a few plants with aromatic seeds, like coffee, and in our own time a few rubber plants. That is certainly a meagre list compared with all those staple plants that have nourished mankind since men first came into existence—wheat, barley, rye, maize, rice, potatoes, dates, bananas, and so forth. And we know for certain that all these crops, in the Old World and the New, have been known for two thousand years, and several of them for at least five or six thousand years.

After the discovery of America a great upheaval occurred, when the plants of the Old World spread over vast areas of the New, while some American plants, such as potatoes and maize, manioc and tobacco, tomatoes, cocoa, etc., invaded our ancient lands.

All crops may be regarded as having had three original centres: (*a*) Mesopotamia, Syria, and Egypt (barley, wheat, flax, and the vine); (*b*) China, India, and Indo-China (rice, tea, sugar-cane, cotton, and the mulberry); (*c*) tropical America (maize, potatoes, and tobacco).

Cultivated plants may be classed, according to A. de Candolle, in fifty-one different families. But though they are of such varied kinds they are nearly all phanerogamous, with scarcely any cryptogams (such as the cultivated mushroom) among them.

From the original home of a plant before it was cultivated it would have been quite impossible to deduce and foresee the enormous area it was to conquer in its cultivated form.

*The area covered by cultivated plants in general, as well as by each particular plant, continues to undergo changes, due to technical progress, to economic necessity, and to the dictates of the human will. The system of cultivation formerly in use was above all *extensive*. After certain lands had been tilled the area of cultivation was shifted, the land first occupied being abandoned, either temporarily to give it a rest, or permanently, as is still the practice in primitive communities like the Fangs of the Congolese forest. (See Chapter V, p. 147.) But owing to new chemical discoveries and the never-ending improvements in transport, the method of cultivation changed. It became *intensive*, in a twofold sense. First, the soil was carefully prepared and more suitably manured, and the yield was in consequence much greater. Secondly, the number of plants grown on a given area was restricted, and endeavours were made to obtain a more remunerative plant by modifying the soil and the methods employed.

Between these two kinds of cultivation—that of earlier civilizations and the most up-to-date system—our Western European countries are at present in an intermediate position, where cultivation, if not *specialized* in the sense used above, is none the less in most cases *intensive*. These two terms are not contradictory, but the two things do not always go together. We have already seen (Chapter II) that it is not from the most naturally fertile and best-watered lands, in which specialization is easy, that men set out to get the most productive and intensive harvests. The characteristics of human intervention in agricultural progress are as follows: choice of species and varieties, scientific war against diseases, improvements in methods and implements of cultivation, choice of more suitable crop-rotations, development of drainage and irrigation systems, construction of barrage reservoirs, drainage of wet and sea areas, and, lastly, the systematic use of fertilizers. And, in his endeavour to extend the area of cultivation, man has gone so far as actually to *make land*, in the form of polders, the draining of the Pontine Marshes and the extremities of the Nile delta, and so forth.*

Man has discovered and developed the principal crops in order to satisfy his need of food and clothing. Most food plants are grown either for their seeds (wheat, barley, rice, maize, etc.) or for their fruit (orange, pomegranate, fig, olive, date, banana, oil-palm, melon, and the American tomato and pineapple). In some cases it is the tubers or roots that are used for food (turnip, carrot, onion, in the Old World, and potato and manioc in the New), while some are even grown for their leaves and stalks, like cabbage and asparagus. Of textile plants some, and not the least important, like the cotton plant, are grown for their seeds, but the majority provide man with thread from the fibre of their stems or leaves (flax, hemp, jute, ramie, and the American aloe).

How and by what process man has come to domesticate animals is a problem of prehistory or protohistory which is not for discussion here, and it is less important for geographers to inquire which species were domesticated first than how domestic animals are distributed to-day.

*The animal population, in fact, is closely connected, through the business of stock-raising, with different agricultural systems, the study of which is of great importance among man's various ways of living. There are some lands in which stock-raising is entirely predominant over vast areas where the cultivator is not in evidence, and others where agriculture dispenses with stock-raising and flourishes on land almost entirely free from the beasts man uses to assist him. In France, however, the two systems—agriculture and stock-raising—are closely associated with each other. In such temperate and highly civilized lands as ours the farmers keep an assortment of domestic animals—cattle, sheep, poultry, etc.—whereas in the great stock-raising regions of the world *specialization* is the rule—the great flocks and herds of Australia, the Argentine, and so forth.

The conditions under which stock-raising is carried on vary according to the nature of the country, the other occupations of the people (see Diagrams XXXIV–XXXVII in Chapter VIII, pp. 204–205, for curves showing the employment of agricultural labour throughout the year), the character of the flocks and herds, and the economic ends in view—whether beasts are reared for draught purposes or for slaughter, for the production of milk, wool, hides, furs, etc., or for several of these purposes at once.

In some regions the cattle live regularly on grass in the open air, as on the Channel coast of France, for example, while in others, where pasturage is scanty or where they are kept for fattening rather than for breeding, they live in the cowshed, as on the large-scale commercial farms of Northern France. In this case the fodder is either eaten green in the cowshed or mown and dried into hay, which is stacked in huge ricks on the edges of the fields. Yet another method is for the sheep and cattle to graze on the fields after harvest, this kind of pasturage being useful also for manuring the soil.

Over wide areas unsuitable for tillage or not yet broken up by the patient toil of the ploughman, the system of *extensive* stock-raising prevails. This is the case with all those great flocks and herds that move from pasture to pasture in dry regions (see below, §§ 6, 7), as well as with the summering of cattle in the mountain pastures during part of the year. (See Chapter VII.) But this extensive system, formerly the most widespread, is now replaced by *intensive* stock-raising of a much more settled nature. The beasts are dispersed over smaller areas, and each plot of ground has to produce as much as possible, so as to provide the maximum amount of food for a beast. Two further results of this large-scale stock-raising on areas of reasonable size (from the point of view of feeding in particular) are the production of considerable quantities of manure and the cultivation of animal feeding-stuffs, both of which improve the productiveness of the land.

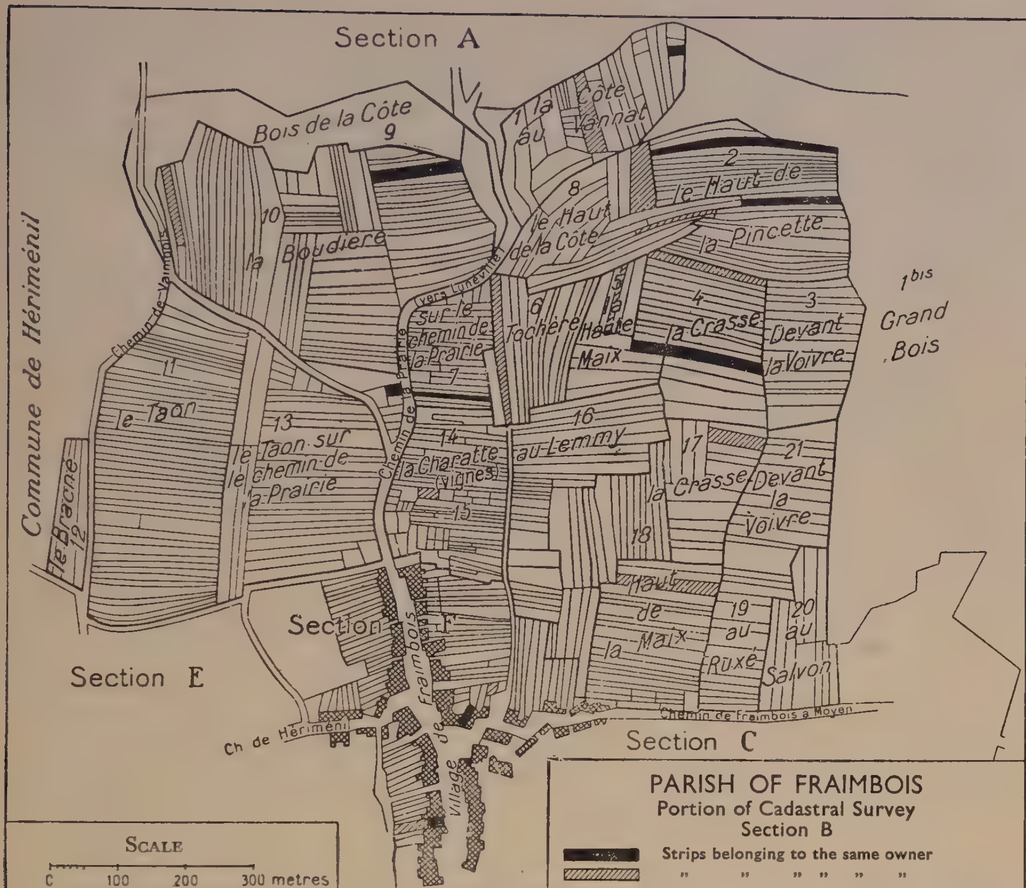
Cultivation and stock-raising thus go hand in hand and help each other: intensive stock-raising needs intensive cultivation, either in the same area or in a complementary one. This agricultural combination or association is one of the primary characteristics of this type of stock-raising, whereas *extensive* stock-raising is incompatible with organized cultivation.*

*Agrarian Geography and the Rural Landscape (*see* Figs. 61–67)

In the light of these studies it is once again made evident to how great an extent the life of the French countryside is dominated, and has been dominated throughout history, by the task of reconciling cultivation and stock-raising, the ploughed field and the farm stock, those two essential features of the conquest of the plant and animal worlds. The social and rural servitude involved in this combination of pursuits has left its mark on the geographical appearance—the rural landscape—of the various parts of France.

Jean Brunhes and Pierre Deffontaines, in *La Géographie humaine de la France dès 1926*, set down the following facts concerning the principal types of rural landscape in France:

"Throughout our French countryside the soil is clad in coverings of two main kinds. First there is the landscape of the cultivated field, where the surface appears at first sight entirely taken up by a chessboard pattern of crops. Trees are few and far between, and the houses, instead of being dispersed among the furrowed fields, are clustered together in small towns, forming a vague mosaic like a piece of cloth chequered with squares and oblongs of many colours, according to the rotation of crops and



**Map XXVI*

The Open Fields of the Parish of Fraimbois (Lorraine)

The arable portions are narrow strips, without fences, bearing the mark of former communal cultivation. The arable is divided into three sections (*A*, *B*, *C*), each owner possessing strips in each section. The land is thus very much divided, and this scattering of strips would seem at first sight incompatible with any rational economy. But this is by no means the case if we consider another feature—that each section grows only one kind of crop. Thus Section *A* will grow wheat, Section *B* oats and vegetables, and *C* will lie fallow. Each section, then, has a different crop from the others, so that an owner has the benefit each year of different crops. Moreover, the crop grown on each section is changed each year, thus preventing the exhaustion of the soil. This rotation of crops is a three-yearly one, so that after three years *A* returns to wheat, *B* to oats, and *C* to fallow. So, at the various seasons of the year, the cultivators are doing the same work at the same time in the same section, this division of labour being minutely regulated. When a section lies fallow, and after the crops are harvested, the fields are thrown open to the common flocks and herds to graze on them without hindrance.

The houses are similar to those shown in Diagram VII (*p.* 62). They are the homes of small proprietors, built close together in two rows on either side of the street. In the words of Cholley and Froelich, "Fraimbois is a good example of a type of village that forms a real rural community" with all its requirements: the system of work in common, rules observed by a kind of tacit understanding, and the organization of the land.

From a study by A. Cholley and A. Froelich of the village of Fraimbois in "Information géographique," No. 3, 1936–37, pp. 130–132.

the changing seasons of the year. Elsewhere, on the other hand, the landscape is a wooded one, with clumps and groves of trees, not in true forest masses, but mainly in rows like long green tapestries serving as fences or partitions between the fields—a landscape of trees and ploughed fields that might be called by the American term *park* or by the old French *bocage*, or woodland. It is pre-eminently the kind of land for scattered dwellings. The peasants have at all times recognized the difference between these two kinds of landscape and have given them expressive names that distinguish between the cultivated 'champaign,' or 'wheatland,' areas and the more wooded landscapes—'clearings,' or 'ryelands'—with hedges of trees or bushes.

"But it is a curious and important fact that these two types of landscape are not rigorously or exclusively connected with physical conditions of soil or climate. There are vast areas where the woodland type covers soils of the most varied character. . . . On the eastern border of Vendée the line of demarcation between woodland and arable by no means coincides with the geological line between the impermeable crystalline rock and the permeable limestone. Since very early times the woodland has overflowed into the limestone country as far as Vouneuil, on the outskirts of Poitiers, and only to-day does it seem inclined to retreat. Farther north, in the Caen and Alençon areas, the hedges of trees are invading the chalk zones. . . .

"Although physical conditions, then, always have a very real influence on general features and on their secondary characteristics, they do not suffice to explain the existing distribution of landscapes. These are literally the work of man—one might almost say they are constructed by man. . . . Geography is not simply a matter of geology and climatology: it is equally a matter of economic and social history."[1]

It is to Marc Bloch, editor of *Annales d'histoire économique et sociale*, that credit in 1931 belongs for showing that the facts observed were largely to be explained by studying agrarian systems, such as the origin of property, the distribution of land and its manner of cultivation, agricultural education, and agrarian methods. The irregular hedge-bordered fields in the woodland areas—the English 'enclosures'—go along with the system of scattered dwellings, and are the expression of a particular mode of distribution and cultivation of land in small portions, not subject to the servitude of the common field system. In contrast to this, the long, open, unenclosed fields of Northern France, where dwellings are more concentrated, are the expression of compulsory rotation of crops and compulsory common pasturage. This primary distinction is naturally accompanied by some anomalies and varieties, which appear on detailed analysis to be increasingly numerous and necessary. (See Map XXVI and Figs. 64–67.)

To such an extent, then, are the appearance of the countryside and the rhythm of agricultural life (see Diagrams XXXIV–XXXVII, pp. 204–205) marked by the peculiar characteristics of labour and production in connexion with stock-raising and cultivation that Roger Dion, in his *Essai sur la formation du paysage rural français*, makes this particularly suggestive remark:

> In the kind of investigations with which we are concerned we shall learn more by pondering the saying of the Lorrainer, that "the difficulty lies in feeding beasts in winter," and that of the Provençal, that "the difficulty lies in feeding them in summer," than by comparing the rocks that make up the soil of their respective lands.

Studies of rural life constitute a new branch of geography—*agrarian* geography—whose function it is, in the word of D. Faucher, "to analyse the relations between the various forms of agriculture and the environment in which they find their support and concrete expression."*

[1] *La Géographie humaine de la France*, vol. ii, p. 330.

The number of plant and animal species that man has successfully domesticated is extremely small. Out of a total of 140,000 or 150,000 species of plants the number of those of real economic and geographical importance, excluding exceptional cases and luxuries and including only those in common use, is not more than 300—barely one species in 500 natural ones. In the animal world the proportion is even lower. There are whole classes of invertebrates from which man has not selected a single one. Of the entire group of molluscs he cultivates the oyster alone, and of the Articulata, comprising ten times as many species as the entire vegetable kingdom, he cultivates only the bee, that provides him with honey, and a few insects that give him silk. Compared with the millions of animal species, the number of domesticated ones can be put at the very modest figure of 200.

These two calculations should not, however, blind us to the enormous extent of the earth's surface that has been transformed by man with the help of these 300 vegetable and 200 animal species. So extensive, indeed, are the areas subjected to these species under man's guidance that his efforts, however slight from a numerical point of view, are geographically prodigious, as will clearly appear from a few short notes on some of the principal kinds of crops and stock, chosen as geographical types.

In these notes we cannot undertake to make complete studies, for that would need whole books. We shall merely try, in these fragmentary sketches, to introduce a few principles of *geographical logic*.

3. The Principal Cereals chosen as Types of Cultivated Plants

Wheat, Rye, Oats, Barley, Maize, and Rice

Wheat

Most of the food consumed by mankind consists of cereals, and of these wheat, broadly speaking, takes first place by the extent to which it is grown (upward of 250 million acres in 1939) and the importance of the trade to which it gives rise. The production of wheat —1500 million cwt. in 1937—is much the same, in very good years, as that of rice. It is one of the most ancient cultivated plants in the Old World, having been grown by man for at least six thousand years. Grains of wheat have been found among the remains of prehistoric lake-dwellers, and in some of the tombs of Egyptian mummies. What, then, are the geographical conditions that explain the general distribution of wheat?

(*A*) Warmth. Wheat needs a fairly large amount of warmth, but it may ripen very fast, and this in some favourable cases shortens the necessary period of warmth. Wheat that requires from 250 to 270 days to grow on the shores of the English Channel needs only 120–135 days in the hot parts of Russian Central Asia.

In Canada spring wheat ripens in the west in 100 days: "Prelude" even takes less than 90 days. Early ripening has to-day become one of the essential properties of wheat, allowing it to develop in northern regions (as far as about latitude 60° N. in Western Canada, Sweden, and the U.S.S.R., and even up to 65° N. in Norway), where the plant can take advantage of the warmth and light of the long sunny days of summer.

Generally speaking, wheat cannot stand cold, and, above all, great and frequent changes of temperature: it is far more averse to temperate winters with alternating frost and thaw than to more rigorous ones with abundant snowfall.

(*B*) Moisture. Wheat needs water to make it grow, especially in spring, but it cannot stand very wet climates, and is not found in the regions of heavy tropical rainfall.

In the monsoon countries it is grown where the rainfall is less abundant, as on the Indo-Gangetic shelf in India, the Hoang-ho area in North China, and the middle part of Japan. For the same reason it cannot stand very wet soil, and in places where the surface soil is not sufficiently permeable it has to be drained, sometimes very deeply, as in Brie, to the east of Paris, and, more generally, it is necessary to draw deeper furrows at intervals to carry off the water.

Wheat stands excessive drought better than excessive moisture so long as it is assured in one way or another of the necessary minimum of water. It can resist exceptional cases of drought because it can send down its roots to a depth of five or six feet, and early-ripening varieties may ripen before the great droughts begin, as in Australia. It adapts itself well to very dry and very permeable soils if there is an impermeable stratum underneath to make sure of the moisture it requires, as on the plain of Beauce. It also accommodates itself to regions of very great summer dryness, as in Turkestan, provided that enough water is supplied by irrigation to the underground parts of the plant. By means of irrigation wheat-growing has spread to the very edge of the desert (the Thar desert and in Egypt) and over vast areas, as in the United States, where 90 per cent. of the irrigated land in Arizona is under wheat. Wheat is suited to regions of scanty rainfall — as little as 16 in., or even 10 in., a year. Here irrigation is no longer possible through lack of resources and of reserves of water, so recourse is had to 'dry farming,' as on the Algerian tablelands and the Bad Lands of the Western United States.

The wheat-growing area in the west of the United States has been enormously extended in the last few years by the employment of 'dry farming.' By this method a field is alternately cultivated and left fallow, so that it yields only one crop in two years. The soil is constantly tilled, even when it is not sown, so that evaporation is reduced and enough moisture is retained in the earth to make a good crop of wheat grow and ripen. It should be observed, however, that dry farming gives the best results when the annual rainfall occurs mainly at the beginning of spring. In the driest parts of the dry-farming area the period of water conservation should be longer, and a crop of wheat can hardly be obtained more often than every third or fourth year.

(C) Soil. Wheat is an exhausting crop, and needs a rich soil, such as clay or fluvial or glacial alluvium, either in the stratum in which it is sown (like the 'black earth' of Russia) or in neighbouring strata (as in Beauce). So much does it exhaust the soil, in fact, that it is never sown in two successive years on the same land. (See Map XXVI, p. 105.)

The land must either be allowed to rest or be sown between two crops of wheat with plants which have the property of restoring nitrogen to the soil, and thereby enriching it, such as clover, white lupin, beet, etc. The most suitable soil for wheat is either the rather mixed clay, neither too solid nor too impermeable, that has been spread by ancient glaciers over much of Central Europe and North America, and called glacial or fluvio-glacial clay, or else those beds of stiff soil that cover the muddy tablelands of Northern France (Picardy, Soissonnais, etc.), or, again, that finer clay, without gravel, whose origin is more complex and controversial, called *loess* (in Central Europe, the United States, and the great yellow-earth areas of China). In fact, we find wheat on all the tablelands of Central Europe that are covered with mud or loess, and the same applies to North America.

(D) Labour. Throughout the whole of its growth wheat needs a considerable amount of human labour, and wherever it is grown intensively or for export a great many hands must be available. From this cultural necessity there result the following geographical facts. Either the population of the cultivation area is large (as in the upper valley of the

Ganges), or else wheat-growing means a demand for labour—*i.e.*, regular migrations (as in Northern France, Southern Russia, and Western Canada)—or else man makes up for the lack of human labour by constructing and using machines of ever-increasing efficiency and ever-increasing cost: this is the solution adopted on the great wheat-growing plains in the middle of the United States, and also in Canada.

If we now study a general map of wheat cultivation we can see how the principal producing countries owe their supremacy to a more or less perfect combination of these various geographical conditions, as follows:

(i) *United States.* (*A*) Very great summer warmth. (*B*) Moisture, especially in spring, and due mainly to the melting of the snows. (*C*) Glacial clay on the sites of ancient ice-sheets. (*D*) Maximum mechanical efficiency instead of human labour.

(ii) *Canada.* The same general conditions as in the United States. The Canadians, profiting by the long experience of their American neighbours, have brought to still greater perfection from the very beginning the cultivation, treatment, storage (note their magnificent elevators, Fig. 93), and marketing of wheat. Their progress is astonishing: production increased threefold in twenty years, from 36 million cwt. in 1910 to 108 million in 1930.

(iii) *U.S.S.R.* (*A*) Great summer warmth. (*B*) Moisture provided by the melting of the snows. (*C*) Black earth (*tchernoziom*). (*D*) Periodic migrations of great numbers (at least five or six million at the beginning of the century) from the more populous black-earth zone in the north to the southern area at harvest time.

(iv) In *France* conditions are far more varied and regional. Almost everywhere except in the mountainous parts conditions *A* and *B* (warmth and moisture) are adequate for wheat, though not perfect. In general it is conditions *C* and *D*, the richness of the soil and a fairly dense population, that have determined the cultivation of wheat. Where the agricultural population is smaller there is a demand for foreign labour for the harvest (Belgians and Poles in Brie).

Another chapter in true human geography would include a study of the harvest dates in the various countries. Wheat is in a high degree a *world* product, the subject of world-wide trade. The wheat-growing countries may be said to be interdependent, and such is man's need for wheat that, owing to the changing seasons and the geographical situation of the various regions, there is always some spot on the globe where human communities are binding the sheaves and threshing the ears of wheat.

PRINCIPAL AREAS WHERE WHEAT IS HARVESTED EACH MONTH

January	New Zealand, most parts of Australia, some parts of South America—for example, Chile.
February	Upper Egypt, Eastern India.
March	India.
April	Lower Egypt, Asia Minor, Syria, Cyprus, Persia, Mexico.
May	Morocco, Algeria, Central Asia, Persia, China, Japan, Florida.
June	Southern United States, California, Oregon, Mediterranean peninsulas, Hungary, Rumania.
July	Central United States, Southern Russia, Rumania, Bulgaria, Hungary, Switzerland, Germany, France, Southern England.
August	Northern United States, Canada, Central Russia, Poland, Denmark, Holland, Belgium, Northern France.
September and October	Scotland, Northern England, Sweden, Norway, Northern Russia.
November	South Africa, Santa Fé (Argentine), Peru, Northern Australia.
December	Rest of Argentine, Chile, Southern Australia, Rio Grande do Sul (Brazil).

It is interesting to study the statistics after noting these geographical points.

PRODUCTION OF WHEAT

(in Millions of Cwt.)

COUNTRY	AVERAGE FOR 1917–21	1922	1932	1938
United States	227·1	234·5	125·7	253·3
Canada	64·2	108·8	117·3	95·2
India	90·0	99·8	91·7	109·6
France	67·8	66·2	90·1	94·0
Argentine	52·4	51·4	63·0	87·0
Italy	45·2	43·9	75·1	80·9
Spain	37·6	34·1	48·5	33·0 (1936)
Australia	27·8	29·0	54·4	41·0
Germany	24·4	19·5	50·0	55·7
Rumania	19·0	25·0	16·2	48·2
U.S.S.R.			269·0 (1930)	442·4 (1937)

In 1900 world production of wheat reached 711 million cwt. In 1932 it totalled about 1000 million cwt., to which must be added about one-fifth—say, 200 million cwt.—for the approximate production of China, and much the same figure for the U.S.S.R. In 1939 production in the U.S.S.R. was 1035 million cwt. (461 million cwt. in Europe), and in 1940, 968 million cwt. (370 million cwt. in Europe).

Contrary to all forecasts, there were serious crises of over-production of wheat between 1929 and 1939. Moreover, measures adopted by various countries—not only for economic reasons, but for political ones as well—upset the wheat market. *In 1946, on the other hand, the world experienced a grave shortage of wheat: the stocks of the four chief exporting countries—the United States, Canada, the Argentine, and Australia—fell from 46 million tons in 1943 to 22 million tons in 1945, and European harvests yielded only 23 million tons in 1945, as compared with the pre-war figure of 45 million tons.*

Along with the growth of the world market has gone the extension of wheat-growing in regions possessing the best geographical conditions for its cultivation—the United States, Canada, the Argentine, and the U.S.S.R. Generally speaking, the areas under wheat are far more extensive than formerly in the Northern Hemisphere, and, conversely, wheat-growing diminishes in lands where geographical conditions are less perfect. In such lands it diminishes in extent and in total production, but relative production increases: the yield per acre is greater because the more wheat-growing has to struggle against unfavourable conditions the more perfect does the process of cultivation become. For example, wheat-growing has diminished appreciably in the British Isles, in Belgium, and in France, but in the first two of these countries the yield is from 16 to 20 cwt. per acre, and in the third from 9 to 14 cwt., whereas in the United States and Canada the average yield is only from 6 to 9 cwt. per acre.

"Wheat has become one of man's principal articles of commerce: there are wheat routes, wheat ports, wheat ships, and a wheat policy. This was apparent even in the ancient world, where Athenian policy was to a large extent determined by the need for good relations with the northern coasts of the Euxine. In Rome the question of supplies from Tunis and Egypt often dominated both the internal and the external aspect of public affairs. And the influence of wheat is no less powerful in our own day. . . . A line of intense activity stretches over the globe, joining producers to consumers and linking regions and peoples of varying aptitudes to a food commodity of primary necessity."[1]

And the storage, transport, and distribution of wheat are facilitated by the fact that it can be sucked up and poured out like a liquid.

[1] Raoul Blanchard, "Le Blé dans le monde," in *Revue des cours et conférences*, January 20, 1914, pp. 474–483.

Other Cereals of the Temperate Zone

Having now defined geographically the wheat-growing areas, we will briefly examine the distribution of the other cereals of temperate lands by reference to that of wheat.

Rye

Rye is a hardier plant than wheat, adapting itself to less warmth, more moisture, and poorer soil, besides needing less attention. It is found outside the wheat areas where the latter is becoming scanty, and inside them where the wheat does not thrive, either from the poverty of the soil or from a too moist climate, as in Brittany, Limousin, and Morvan. Rye is grown in the Alps at a height of 6500 feet, or even higher. In short, it overflows the limits of wheat in altitude and latitude alike. It forms a kind of ring round the wheat zone, especially in the north, where general conditions are less favourable to wheat.

Rye flour is made into bread and biscuits, and rye straw makes an excellent roofing thatch, besides being used in the manufacture of paper. In the greatest rye-growing country, the Soviet Union, this cereal is used for making vodka, and in the Anglo-Saxon countries whisky is made from it. It is the only cereal in which Europe, including the Soviet Union, is self-supporting.

Oats

Despite the success of recent attempts to introduce this cereal into the human dietary, it is still used mainly for beasts, especially horses, and the oat zone is on the whole closely connected with the horse-rearing zone. If the climate is one of cool and moist summers, oats thrive well, and they are found in those parts of the wheat zone where the summers are least warm and dry.

But the falling-off in the employment of horses in transport, in agriculture, and in the army has led to a reduction in the production of oats, notably in France, where the development of motor transport put an end to the trade in oats.

Barley

Barley is a very ancient cereal still used for human food, for animal food, and for making beer. It is a more valuable grain than rye, and bids fair to be used much more extensively for human food. It belongs geographically to the wheat zone, and its chief characteristic is that it is perhaps the most adaptable of all cereals. We find it scattered throughout the whole of the wheat zone, to its extreme limits, and it is met with alike in Norway at latitude 70° N. and in the Saharan oases at 25° N. In France brewing barley has suffered serious competition from crude rice and maize.

Maize

Maize, the chief cereal of the New World, is one of the most important products that we owe to the discovery of America. In the Old World the various names given to it indicate alike its recent introduction and the doubt that men have felt regarding its true origin. Thus in Western Europe it is called *Turkish corn*, in Turkey it is *Egyptian corn*, in Egypt its name is *Syrian durra*, and the Canadians call it *Indian corn*. Though used in

the Old World as a secondary cereal, it is the traditional grain of the older races of North and South America.

In Mexico the national dish is the *tortilla,* a flat baked cake of maize. Only in two European countries has maize gained an important place in human consumption. These are Italy, where *polenta,* made of maize flour, has become a national dish, and Rumania, with its *mamaliga.* The cultivation of maize extends from Southern France to China.

Maize requires more warmth and more moisture than wheat, so it can thrive in an amount of humid heat that would be harmful to the latter, and it can be grown anywhere in the tropics. But it needs as much care and labour as wheat. From the study of maize there emerge two essential points. It is a product of wetter and warmer regions either south of, or within, or around the wheat zones. Rice is pre-eminently the cereal of the very hot and very wet parts of the globe, and the geographical conditions needed for growing maize give it a kind of intermediate position between the wheat zone and the rice zone.

In two particular cases this general statement is very clearly verified in concrete form. In the plain of the Po wheat, maize, and rice are found in succession, in roughly concentric zones of varying humidity. And, similarly, in the great north-south valley of the Mississippi we see that the principal wheat areas are situated towards the north, the rice plains near the coast of the Gulf of Mexico, and the maize-lands in the middle, between the wheat and the rice. In China and Indo-China I have seen maize grown on terraced slopes above the rice-fields.

Secondly, maize is a type of crop whose *actual* geographical area is far from co-extensive with its *possible* geographical area. Even to-day it is still to a preponderating extent an American grain, though in view of its American origin it is surprising that it is already playing such an important part in the life of certain parts of the Old World.

Maize flour is in the first place an important item of food in the area of surplus production in the United States called the Corn Belt. Maize is used also for fattening hogs, and, to a smaller extent, cattle, which are raised in large numbers in the maize-growing states. It is fed also to horses and mules. But it is also grown extensively for fodder, especially in dairy-farming districts, even when the warm season is too short to permit the ripening of the grain. It is cut when green and stored in silos, forming a very important and even vital part of the winter ration, and very often of the ration for the whole year.

Having thus outlined the geographical distribution of these cereals, we will examine some comparative figures.

TOTAL PRODUCTION
(*in Millions of Cwt.*)

	1900	1909	1921	1932	1935
Rye	396	416	280	252	461
Oats	178	636	505	507	677
Barley	178	338	310	302	418
Maize	705	944	1080	914	1092

The last date given is 1935, because at the time of the compilation of this table all the figures for the U.S.S.R. for 1938 were not known to us. The production of maize suffered least from the 1914–18 war because the New World is the greatest producer.

CROPS OF THE PRINCIPAL PRODUCING COUNTRIES
(*in Millions of Cwt.*)

RYE

	Average for 1917–21	1922	1932	1938
Germany	59·2	52·3	83·6	86·0
Poland	44·6	50·1	64·1	72·5
United States	17·9	24·2	10·1	13.0
Czechoslovakia	11·0	12·9	21·7	16·0
France	9·0	9·7	8·9	8·0
Hungary	2·5	6·4	8·1	8·0
U.S.S.R.			236·0 (1930)	213·0 (1935)

OATS

	Average for 1917–21	1922	1932	1938
United States	195·2	174·4	180·3	152·9
Canada	67·2	75·7	60·8	57·0
Germany	47·4	40·1	66·5	63·0
France	34·6	41·8	51·2	54·0
Poland	22·6	25·0	23·7	26·0
Great Britain	16·2	12·7	25·2	20·0
Czechoslovakia	9·7	10·4	16·6	12·0
U.S.S.R.			166·2 (1930)	182·0 (1935)

In 1938 Sweden produced 13 million cwt. of oats.

BARLEY

	Average for 1917–21	1922	1932	1938
United States	41·2	33·7	65·3	54·0
Rumania	14·7	9·8	17·9	8·0
Spain	19·7	19·4	27·7	17·0 (1936)
Germany	17·9	19·3	32·1	42·0
Poland	8·4	12·2	15·3	13·0
France	8·3	8·3	11·6	12·0
U.S.S.R.			67·7 (1930)	81·0 (1935)

In 1937 China produced 63 million cwt. of barley and India 23 million cwt., while Canada produced 22 million cwt. in 1938.

MAIZE

	Average for 1917–21	1922	1932	1938
United States	820·5	779·4	741·9	645·0
Rumania	46·2	28·1	54·3	50·9
Italy	22·6	24·5	26·9	29·0
Hungary	12·7	8·0	24·3	26·0
Spain	7·0	6·3	6·7	7·0 (1935)
Bulgaria	5·3	8·7	10·5	5·0
U.S.S.R.			26·6 (1930)	27·9 (1935)

In 1938 the Argentine produced 54 million cwt. of maize, Yugoslavia 47 million cwt., and the Union of South Africa 25 million cwt.

Rice

Rice, like wheat, is a plant of great antiquity, even more important for food than wheat. It feeds some 650 million human beings—one-third of the world's population.

Geographical Conditions

(*A*) AND (*B*) WARMTH AND MOISTURE. Rice requires *great heat and moisture.* Lands where heat and rainfall are both great all through the year, but particularly in summer, are favourable to its cultivation, which needs a great deal of water. "Rice can be grown only in countries where considerable quantities of water are available, either from rainfall or from irrigation, during its period of growth."[1] It can produce several crops in a single year—in Java, for instance—and two crops are the normal yield on the rich, low-lying lands of Annam and Tonkin. The countries best suited to rice-growing are the monsoon lands, especially in South-East Asia, including China.

(*C*) SOIL. Rice needs a light, rich soil, generally of low relief, since it should be not only watered but flooded. The alluvial regions of the large and small deltas of the Far East of Asia are well suited to its cultivation.

(*D*) LABOUR. A very dense population is necessary, for rice calls for the labour of a great many hands, and involves continuous toil. The preparation of a rice-field needs the most careful attention. (See Fig. 87.) The work of digging, sowing, and, above all, planting-out is hard and unhealthy. Then, when the rice is fully grown, the fields have to be drained and the crop harvested by hand, with the sickle. And even then there remains the husking of the grain, another laborious task.

"How is it," asks Woeikof, "that a cereal so difficult to cultivate has managed to take root in so many lands and become the principal food of hundreds of millions of men? There are two reasons: (*a*) rice-growing has made possible the utilization of marshy ground where no other cereals can grow, and its yield, too, is very great; (*b*) it is very quickly and easily digested—an important matter in hot, humid countries where other cereals cause digestive troubles."[2]

Rice-growing, however, is not confined to densely populated regions where most of the rice is consumed in the production area, though if it is to be exported the labour that it necessitates must be reasonably cheap. The main producing countries are, first and foremost, China and the neighbouring monsoon lands—Japan on one side and India, Indo-China, and the Netherlands Indies on the other. But the cultivation of rice has developed also in two other groups of regions:

(i) Africa and, later, after the discovery of the New World, America, where natural conditions are generally similar to those of the Asiatic Far East in respect of warmth, humidity, and alluvial and marshy soils, and where an appreciable increase in the population provides an adequate supply of labour. These regions include the Guinea coast of West Africa, watered by the summer monsoon; in East Africa the region of the great lakes, the Mozambique coast and lower Zambesi, and the Imerina plateau in Madagascar; in North America, the low-lying, hot, and well-watered area of the lower Mississippi and the coast of Mexico.

(ii) A few countries with warm and dry summers, where the necessary conditions of soil and population are fulfilled, and where the lack of rain has been made up for by irrigation—the lower parts of the Nile delta and the basin of the Po.

[1] R. Blanchard, "Le Riz dans le monde," in *Revue des cours et conférences*, February 20, 1914.
[2] "La Géographie de l'alimentation humaine," in *La Géographie*, vol. xx (1909), p. 228.

Rice production since 1914 showed a continual advance until the Second World War on the figures for 1909–13, reaching a total of 1421 million cwt. in 1936–37. Production in Asia, already so greatly preponderant, generally increased (95·4 per cent. of world production), the chief producing countries and their production (in millions of cwt., for the year 1936–37) being as follows: China, 480 (estimated); India, 400; Japan (including Korea and Formosa), 170; Burma, 70; Indo-China, 65; Netherlands Indies, 58; Siam, 47. Production in Africa, despite fluctuations, has on the whole remained almost stationary, and the very small American production has made a great advance. Events in the Far East have seriously interfered with rice production, and it has been estimated that the world supply of rice was three million tons short in 1946, while entire regions have been ravaged by famine.

Rice, then, which feeds so many people, is of great importance in what Woeikof calls the *geography of alimentation*, but it plays a much smaller part in the geography of communications.

Whereas the amount of wheat that entered into foreign trade before the War averaged some 200 million cwt., or one-fifth of the total production of the world, the quantity of rice was much smaller, both absolutely and in relation to production. The importance of the international trade in rice increased considerably, however, until the War. Total exports, in fact, rose from 46 million cwt. before 1914 to 80 million during 1938. Most of this was accounted for by trade between Asiatic countries producing a surplus and those whose production was insufficient: if the average amount of rice entering annually into international trade during the five years before the War is put at 65 million cwt. more than 40 million of this was between countries in Asia.

The three countries exporting most rice were Burma (through Rangoon), Siam (through Bangkok), and Cochin-China (through Saigon). These were responsible for 80 per cent. of the total exports in 1937.

Nowhere in Europe is rice consumed in any quantity except in Italy, where, indeed, it is cultivated, and where the annual consumption is $15\frac{1}{2}$ lb. per head. France was the greatest European importer of rice, almost entirely from Indo-China, and her consumption has increased nearly to that of Italy.

Taking good and bad years together, Indo-China produced as much 'paddy,' or unhusked rice, as France produces wheat—say, about 70–80 million cwt.—and Cochin-China is by far the greatest producer and exporter in Indo-China. She should aim at playing a part of increasing importance in both these directions, the greatest importers being Singapore and Hong Kong, but to do so she must improve the quality of her rice.

Manioc and Sorghum

Manioc, or cassava, is a plant whose tubers form an essential part of the food of all the coloured races of Africa, but its cultivation is scattered and of far less importance than that of sorghum and the various other kinds of millet. It is from manioc that the valuable tapioca is made.

Sorghum, or durra, a food-plant growing in dry climates, is cultivated not only throughout Central Africa, but also in Japan, China, India, Central Asia, and South America. But precise information is lacking about sorghum, as well as about manioc, and we must be content to mention in general terms the human importance of these plants. Sorghum is the third greatest food-plant, but so far it has not entered into world commerce.

Potato

It is different with that valuable tuber the potato, a native of the New World, but very successfully acclimatized, extended, selected, and improved in the Old. An economical food for peasants, and increasingly indispensable to city-dwellers, it has even become a foodstuff for cattle of the greatest utility. The valuable starch contained in the potato finds easy industrial outlets, also, in starch factories and distilleries. In these circumstances it is impossible to foresee what the ultimate geographical range of the potato will be. It is content with poor and light soil, but it cannot stand frost, a temperature of 25° F. causing serious injury even to the underground parts of the plant. But it is planted as soon as winter is over, and, needing as it does a fairly large amount of moisture, it is from April to June that its requirements are most exacting—the very time when in Western Europe the spring rains and the water of the streams are almost everywhere plentiful.

World Production of Potatoes[1]
(*in Millions of Cwt.*)

	Average for 1917–21	1922	1923	1932	1938
Germany	250·9	406·6	314·7	453·2	508·9
Poland	173·0	332·2	287·2	269·0	345·0
United States	103·9	122·8	112·2	97·7	100·0
France	94·8	126·4	95·3	158·6	170·0
Czechoslovakia	46·6	90·7	62·9	84·0	98·0
Great Britain	33·3	30·7	28·0	46·0	51·9
Spain	28·3	29·5	25·0	51·3	50·0 (1935)
Belgium	23·4	39·5	24·2	35·2	32·0
Canada	30·0	27·1	23·8	17·8	16·0
Netherlands	27·8	37·2	23·5	36·8	28·0
U.S.S.R.					697·0 (1935)

Japan produced 20 million cwt. in 1937 and Italy 29 million cwt. in 1938.

Taking good and bad years together, the annual production of potatoes throughout the world at the present time oscillates around 1500 million cwt. Compared with the total annual production of two other important foodstuffs—wheat and rice—this weight of potatoes is rather greater than that of wheat and less than that of rice.

4. Other Kinds of Vegetable Products

These very sketchy examples have enabled us to grasp what should be our real twofold concern—the geographical explanation and localization of all the main cultivated crops. With regard to other cultivated plants, we shall call attention more briefly to a few sources of information or a few points of view. The general method is to try always to group these phenomena according either to cultural resemblances or to economic connexions, either by their general subordination to similar natural zones or, on the other hand, by the radical contrasts between them.

Olive and Vine

These two plants belong pre-eminently to the Mediterranean and similar regions, but the olive is more limited than the vine to the coastal areas of the so-called Mediterranean countries, and its extreme limits in altitude are 4550 feet in Portugal and 2600 feet

[1] In 1935 the world crop was 2215 million cwt. (*including* the U.S.S.R.) and, in 1938, 1730 million cwt. (*without* the U.S.S.R.).

in Algeria. The vine, on the contrary, extends far beyond the natural limits of this area and climate, and is grown as far northward and eastward as the fringes of those two similar types of vegetation, the northern forest and the steppe.

Geographical Conditions required by the Olive-tree

(*A*) A dry, warm climate during the summer, with an average temperature of 64° F. during the flowering season. (*B*) A climate whose minimum winter temperature does not fall below 18° F., and where winter rainfall is fairly plentiful. (*C*) Light granite or limestone soil for preference; red calcareous sandy soil is much better than compact clayey soil. (*D*) Labour needs to be versatile and skilful. (See Fig. 88.)

Raoul Blanchard has published a noteworthy book on the northern limits of the olive-tree in the French Alps (*La Limite septentrionale de l'olivier dans les Alpes françaises*), showing clearly that the northward advance or retreat of this ancient cultivated plant is determined neither by the nature of the soil (for it grows on all soils), nor by latitude, nor even by altitude, but by aspect. A favourable aspect, facing south or east, with effective protection by rising ground from northerly, north-east, or north-west winds, is the explanation of the apparent anomalies in the limits studied. "Thus the limit of the olive-tree is not a true climatic one. It is not the real frontier of the south. . . . It is an interesting example of the way in which man can extend the cultivation of a delicate plant by strict adaptation to topographical conditions" (p. 324). These weighty statements, founded on so many observations made on the spot, are the more worthy of attention since the olive, though pre-eminently a Mediterranean tree, extends beyond the strict bounds of this region in other places also.

The olive grows in other parts of the world where the climate resembles that of the Mediterranean area. In North America it has become of economic importance in California only. But it is found also on the lofty Mexican tablelands, in Chile, north of latitude 35° S., and around Mendoza, in the Argentine. It is established in South Africa, and it flourishes in the southern part of Australia. As it provides oil, it is identified particularly with those regions where cattle are not reared, so that there is no cow's milk to be made into butter.

The geography of the vine in the Old World—and now in the New as well—gives rise to considerations of equal importance.

This very ancient plant, of exceptional importance to France, Switzerland, and the Mediterranean countries, though smitten almost to death on several occasions when attacked by apparently invincible plagues, has yet been saved. "One after another they came: first the oidium fungus, or grape-mildew, next the phylloxera insect, and then two more funguses, the mildew and the black rot, all failed to bring about the permanent destruction of the vine, for the obstinate persistence of scientists and growers combined to triumph over these repeated calamities. So the vine remains an excellent example of the healing and reviving work of the agronomist."[1]

Geographical Conditions

(*A*) A well-marked warm season. (*B*) Not too much rain. (*C*) Dry or easily drained soil, like that which is often found on well-exposed gentle slopes. (*D*) Labour considerable, active, and, as it were, devoted to vine-growing. When the vine is grown on terraces, as it very often is, the earth itself has to be carried by hand. Continuous human effort is required, and much traditional skill: a vine-grower can never be made to order. Many

[1] *La Géographie de l'Histoire*, pp. 95–96.

kinds of labour are needed throughout the year, and the grape harvest calls for extra hands.

Geographical Distribution

The ordinary vine-growing zone lies between latitudes 27° and 49° in both hemispheres, but 92 per cent. of the total area covered by vineyards is in Europe. (See Fig. 89.)

The limits of vine-growing, however, have been considerably modified. It is withdrawing from unsuitable northern areas and becoming concentrated in the more favourable ones. On the other hand, it is becoming reconstituted, beyond its present natural limits, in an entirely artificial form: excellent table grapes are produced *under glass* around London, and in Belgium and Holland.

Finally, localization, which should be the constant concern of the geographer, should mean the preparation, first of a general map, and then of a series of maps or diagrams in increasing detail, showing the *predilection centres*, and within them the *predilection points*.

* *The Civilizing Rôle of the Vine*

"Vine-growing and wine-making are varied tasks that call for great intelligence and skill. A good vintage wine or a choice brandy are real works of art, bearing witness to long centuries of civilization and resulting from countless efforts and experiments by patient toilers. The vine, undoubtedly a native of Asia, is bound up with the oldest Mediterranean civilization. Wine, beloved of men of the highest culture, has inspired some of the finest verse of the Greek and Latin poets. The vine and its product occupy a place of honour in the scriptures of the two noblest monotheistic systems —the Jewish and the Christian. From the earliest centuries of Gallo-Roman civilization men have sung the praises of Bacchus and of wine. In the art and literature of the Middle Ages vine-growing and wine-making provided many of the stock subjects of poets, story-tellers, and those who carved the porches and capitals of our cathedrals."[1]*

Sugar-cane and Sugar-beet

Sugar in ancient times was furnished by honey; hence the very great importance of bee-keeping in those days. In our own time we are witnessing a return of the demand for honey, and a renaissance of apiculture. But sugar, occupying an important place in the general economy, comes to-day from the cane and the beetroot. Geographically, these two plants meet and join in the Mediterranean basin: the cane is grown in the irrigated parts of Egypt as well as in Spain, and the beet appears to be a native of the warm lands of Spain and Portugal. However, the fiercer the struggle between these two sugar-bearing plants has become, the more have they become geographically separated, so that they belong to-day to quite opposite parts of the world.

Geographical Conditions for the Sugar-cane

(*A*) An average annual temperature of at least 60°–65° F., and especially a very high summer temperature; when the winter is rigorous great trouble may result from cold weather setting in too early, as in Chile, Natal, and Japan, where cultivation is a very risky business. (*B*) Very great humidity—at least 48–56 inches of rain. Much water is needed during the earliest period of growth, much water and heat during the middle period, and much heat without too much rain at harvest-time. (*C*) The soil must be rich, and its quality should be maintained by manuring and irrigation. (*D*) The general tendency to convert the crop into an annual one increases the need for labour. Moreover,

[1] *La Géographie humaine de la France*, vol. ii, p. 463.

regions suited to the sugar-cane are regions of fever, where it is difficult for Europeans to live; hence the introduction of Negro slaves into the Antilles and tropical America.

Distribution of the Sugar-cane

Areas immediately bordering on the great equatorial forests in the two continents—India, Cuba and the southern states of the U.S.A., Brazil, Java, the Philippines, Taiwan (Formosa), formerly belonging to Japan, the Hawaiian Islands, and lastly Egypt, where this crop has been enabled to develop by artificial irrigation and cheap labour. The market is dominated by the United States, since Cuba (which produces half the world total), Porto Rico, Hawaii, and the Philippines are under American government or control. So great is the yield, especially in Cuba, Java, and Hawaii (more than eight tons per acre) that a strict production quota has had to be imposed to prevent a fall in prices.

Geographical Conditions for the Sugar-beet

This is at the same time a very exacting and a very profitable crop. Its cultivation has developed throughout Central and Western Europe on the best soils, and it makes them even better. It calls for such strong and practised labour, for hoeing, singling, etc., that it gives rise to very great temporary migrations in Northern France and throughout Western and Central Europe. It is important to note that soils suited to beet are also the best wheat-lands, so the two crops can be grown in rotation.

"The sugar-beet, one of the best examples of a commercial crop, is a late-comer, owing its cultural destiny, if not its origin, to Napoleon's Continental System. Its yield of sugar is second-rate compared with the great production of cane sugar, but it has other merits: it prepares the soil admirably for wheat-growing and provides excellent cattle-food, thus assisting the plentiful production of both meat and milk, while its waste matter forms a useful manure. These various functions have given it, as it were, a psychological history of capital importance. It is one of those crops that give the cultivator a swift and obvious reward for the sacrifices involved in improving and fertilizing the soil. In many cases, too, it has led the farmer to understand and practise new methods. The sugar-beet led the way in yielding a return proportional to what is given to it. Nor does its importance end here, for it has contributed also to the creation of an easy bond between a form of production that is purely agricultural and an industrial one: in some lands, such as France and Germany, it was the first to bring about that association of cultivation with industry which, by cutting transport costs to a minimum and eliminating the middleman, is the ideal towards which all industrial cultivation should tend. This plant, which yields at the same time human food, cattle fodder, and a raw material of industry, has played a special part in the history of modern agriculture. It enters the cycle of activity of a piece of land that is wisely cultivated, and does not, for the benefit of industry, cause irretrievable and unlimited destruction like its rival from the lands of heat and moisture, the sugar-cane."[1]

Geographical Distribution of the Sugar-beet

The chief producing countries are Germany, the Soviet Union, and Bohemia, which come easily first with a production of upward of a million tons of raw sugar. Next come France, Poland, Italy, Great Britain, Belgium, and the Netherlands, together with the United States in the New World.

The cane, like the beet, should be dealt with immediately after being harvested, so

[1] *La Géographie de l'Histoire*, pp. 94–95.

these crops have necessitated the erection of factories near where they are grown. This, therefore, would be the place for a study of the localization and development of the sugar industry—a real matter of human geography.

The consumption of sugar has gone on increasing at a very rapid pace.

TOTAL PRODUCTION OF CANE AND BEET SUGAR

(1) *Around* 1900

(*To show the conflict between the two and the extraordinary progress arising from this competition.*)

(*in Millions of Tons*)

YEAR	CANE	BEET	TOTAL
1890	2·7	3·5	6·2
1895	2·9	4·2	7·1
1900	3·6	5·9	9·5
1905	4·9	6·9	11·8

(2) *Since* 1918

(*To show continuous increase, especially in cane sugar.*)

YEAR	CANE	BEET	TOTAL
1918–19	11·9	3·8	15·7
1922–23	12·8	5·1	17·9
1930–31	17·6	11·7	29·3
1938–39	17·4	9·7	27·1
1939–40	19·6	11·2	30·8
1945–46	18·1	6·4	24·5

Tea, Coffee, Cocoa

These three trees or shrubs belong to the warm and damp transitional zones, and their products are consumed to an increasing extent, especially in the over-populated parts of the temperate zones. Owing to the development of means of transport, tea, coffee, and cocoa, or chocolate, penetrated almost at the same time—the seventeenth century—into the countries of Western and Central Europe, and all three are to-day in league, as it were, to secure a more and more complete conquest of the general population. On the other hand, their cultivation is often a matter of rivalry and strife: witness the replacement of the coffee plant by the tea plant in Ceylon and the substitution of cocoa-growing for coffee-planting to the east of the Niger delta, as well as in the north of the state of Espirito Santo, in Brazil, etc.

The cultivation of coffee is continuing or beginning to develop in a few French colonies—Madagascar, Indo-China (Tonkin and Northern Annam), New Caledonia, Guadeloupe, and Cameroons.

The tea plant can stand low temperatures that would kill the coffee plant, although both plants need much the same summer temperature, so that coffee-growing is barred from certain regions where tea can live without difficulty.

Various Crops and Products

From the human standpoint three trees might be grouped together—the **date palm,** the **banana,** and the **coconut palm**—which differ greatly, both botanically and geographically, but which have for man this common characteristic—that they enable him to provide for a varied range of wants, and that all parts of them can be put to use. The coconut palm is playing a more and more important part as a producer of *copra.*

A food tree growing in our own latitudes—the **chestnut**—might well form the subject of a comprehensive geographical study, and a complete study of the **tobacco plant,** producing a commodity for popular consumption, grown in many lands, a stimulating luxury and a valuable export, would be of great interest.

*The same applies to the **soya bean**, an importation from the Far East whose extension to Europe, though recent, is marked out for great future development.*

Cultivated and Early Vegetables

*Like the history of cereals and other crops, and for the same reason, the history of fruit-trees, sweet-scented flowers, and, above all, vegetables reveals one complete physiognomic and economic aspect of a region, as well as many successive conquests, of space and species, arising from man's industrious perseverance. The various kinds of vegetables have undergone many changes of fortune in the course of what may be truly called their human history.

"The cabbage has lent itself to all the happy fancies of the selective breeder. For four thousand years it has been used by man for food, and it would be hard to recognize the wild ancestor of our comely *Brassica oleracea* in the humble cruciferous plant still met with on the cliffs and beaches of Normandy, England, Denmark, the Balearic Islands, and Sardinia. The plant beloved of old Cato has been one of man's earliest companions in the Old World, and particularly in Europe in ancient times. Not only so, but freaks of this species have been successfully exploited and made hereditary. Thus in the round-headed cabbage the stem has become atrophied and the leaves overlap to make the head, while by developing the side-shoots in the axils of the leaves man has obtained the Brussels sprouts. Again, when the flowers have been forced at the expense of the other parts of the cabbage the result is a cauliflower. And when use is made of a swelling of the stem at the soil level we get the turnip cabbage, or kohlrabi. . . . Think, then, for a moment of all the patient effort, the repeated attempts, and the successful experiments that are embodied in such a simple story as that of the cabbage."[1]

Although some vegetables were cultivated long ago, and although most of those grown in market-gardens are old inhabitants of our lands, yet the methods of cultivating them by forcing are quite new. The giving up of whole districts to the sole business of vegetable-growing goes along with the extension of city life. To-day an entire and specialized section of the population is engaged in the production and sale of vegetables in the neighbourhood of towns and in areas enjoying a climate favourable to the early ripening of fruit and vegetables, such as Brittany, the Rhône valley, Algeria, Morocco, the Mediterranean coast of Spain, and so forth. The cause of this rapid extra-regional advance is to be found largely in the skilful collaboration of transport organizations and agricultural associations.

"Ease and speed of transport have tended everywhere to turn the market-gardener into a grower of early vegetables, in the sense that the value of his produce depends primarily and to an increasing extent on the day, and even the hour, when it can reach the great markets. Thus there is unceasing rivalry between all the parts of our cultivated land as the voracious urban markets—that of Paris in

[1] *La Géographie de l'Histoire,* p. 82.

particular—strive to obtain all the choicest vegetables and fruit in as continuous a supply as possible."[1]

The fruit trade has benefited more than any other from ease and convenience of transport. The trade in oranges, lemons, bananas, etc., has resulted in vehicles being specially reserved for them (see Chapter III, § 6), and complete arrangements have thus been made to bring to the great consumer countries the fruits of distant orchards.*

Rubber Plantations

The search for rubber began with 'destructive economy,' both on the Amazon and in tropical Africa, and the collection of wild forest rubber still continues. When the earlier French editions of this book appeared in 1910 and 1912 the *latex* of cultivated rubber-trees had scarcely begun to play an important part in the markets of the world: the rubber that we used came almost entirely from the wild trees. But in a few years a great change took place, marked by the rapid advance of cultivation. It is a strange fact that the destructive economy of the Brazilian supply goes on diminishing, though it still continues.

In 1910 the supply of wild rubber amounted to 62,000 tons, and that of the cultivated variety to only one-eighth of that figure—some 8000 tons. In 1920, only ten years later, production reached 360,000 tons, and of this world total only one-eighth was wild rubber. Thus the proportions were exactly reversed. Surely no other vegetable product has ever shown such a remarkable revolution in a single decade?

World Production of Plantation and Wild Rubber (Brazilian and Other Species) (*in Tons*)

Year	Plantation Rubber	Brazilian Rubber	Other Species	Total
1918	200,000	31,450	18,550	250,000
1920	315,000	35,000	10,000	360,000
1922	370,000	22,296	1,600	393,896
1929	835,797	22,598	5,015	863,410
1939	983,030	13,968	20,460	1,017,458
1941				1,600,000

The United States alone absorbs more than 60 per cent. of the total world production, owing to the growth of the motor-car industry and the number of cars in use, and New York has become the largest market for rubber consumption, though London still remained in 1939 the *world* market. Crises of over-production have occurred (1920 and 1922), some of them very serious (1931), in which such infant plantations as those of French Indo-China have suffered. (See Fig. 105.) The War absorbed great quantities of rubber.

Production in 1946 reached the 1941 maximum, just about meeting the demand—but here arises the problem of the distribution of the product.

Malaya is still the country that produces the largest quantities of rubber. In the State of Selangor, in Malaya, I visited in 1923 one of the most delightful new cities in the world—Kuala Lumpur, born of rubber, and owing to this cultivated plant its swift and splendid development: it had 8500 inhabitants in 1921 and 20,000 in 1931.

[1] *La Géographie humaine de la France*, vol. ii, p. 482.

Physiognomic Features accompanying the Various Kinds of Crops

Geographers have, in due course, to observe not only the changes made on the surface of the earth by cultivated crops, but also the secondary arrangements—all the details that can be seen and photographed—accompanying and expressing these forms of human labour.

Thus if we travel through the vineyards on the southern shore of Lake Balaton, or in Burgundy or Médoc, or on the northern shores of Lake Geneva, we shall see everywhere the little shelters of mud or stone that are used as tool-sheds—necessary features of this kind of crop, called *capite* in the canton of Vaud, *mazet*, *bastidon*, or *cabane* (see Fig. 26) in the South of France, *cadolle* in Burgundy, and so forth.

In like manner the choice table grapes called *chasselas*, grown around Fontainebleau, are the result of using low walls to form espaliers and to protect the grapes from the wind, and these parallel walls give a distinctive appearance to the whole of this vine-growing area, as do the fences, walls, and hedges around fields in a more general way. (See Figs. 71–74.)

In the Tyrol the meadows are sprinkled with little huts of rough planks, generally not closed, to shelter the posts, shaped like parrot-perches, on which the Tyrolese peasants dry their hay. Elsewhere, in Bosnia and Croatia, the hay is placed in huge bundles on trees, looking like enormous tufts or tassels. And in Slovenia it is dried on a long wooden rack, called a *kozolec̀*. (See Fig. 91.) In this way a quite special manner of working, due to the dampness of the climate, clothes the earth with small supplementary features of human geography.

In lands still farther north, where summers are so short, the rye has to be stacked on posts to enable it to withstand the dampness of the climate and the ground, and care is taken to make the hanging ears face south, towards the sun. (See Fig. 90.) All the hay is likewise placed upright and spread out to dry by means of posts supporting horizontal bars.

On the well-sheltered shores of Lake Garda are grown lemon-trees whose produce was at one time famous and much sought after, and the curious white-pillared sheds, built to protect them from the winter cold, are a distinctive feature of the landscape. (See Fig. 92.)

Elsewhere it is hemp, hops, red pimento, or golden tobacco leaves that are seen hanging beneath the projecting roofs or drying in festoons on the house-fronts, providing the human landscape for several months each year with a typical form of decoration closely related to the people's crops and their methods of living.

Turning to more complex agricultural and commercial matters, we cannot overlook the significance of those huge and lofty elevators, so numerous in the United States and Canada, used for the storage and distribution of grain—a feature of all railway stations on the prairie, in the great towns, and at the seaports. (See Fig. 93.) And, finally, there are the fences as elements of the landscape, connected with the fields, the roads, and the methods of cultivation, and setting problems in the sphere of geography—physical, human, and agrarian. (See Figs. 71 and 74.)

5. Textile Products of Animal and Vegetable Origin

Cotton, Silk. Wool

In comparing geographically three of the principal textile products—cotton, silk, and wool—we have the advantage of comparing at once the geography of a plant (the cotton-plant), a tree and an insect in close association (the mulberry and the silkworm), and a domestic animal (the sheep).

A Plant Product: Cotton

Cotton is at the present time the most important of all textile plants.

At the beginning of the nineteenth century clothing materials made to meet the needs of the civilized world were 78 per cent. wool, 18 per cent. linen, and 4 per cent. cotton. A

hundred years later the proportions were 74 per cent. cotton, 20 per cent. wool, and 6 per cent. linen.[1]

In our part of the world cotton is tending more and more to replace, not only flax, but also hemp—both plants of very great antiquity in the Old World. Cotton is the plant textile whose production is the greatest, and whose use is most common in both hemispheres and in various latitudes.

Geographical Conditions for Cotton-growing

(*A*) AND (*B*) WARMTH AND MOISTURE. The cotton-plant needs warmth and summer rain, and cannot stand frost or cold winters. It is a perennial shrub, and therefore naturally excluded from regions where the winters are rigorous even if the summers are warm and wet. But when it was found that the best way to get a good crop was to pull up the previous year's crop and replace it every year the cotton-plant became actually an annual. The result is that it can grow in countries with fairly cold winters, so long as the summers are very long and warm, and thus the southern states of the United States have become great cotton-growing areas.

But though needing plenty of rain while it is growing, the cotton-plant does not like rain in its later, or ripening, period. So monsoon lands and those with summer rains, though admirably suited to its needs during the actual summer, involve risk from later rainfall to the good condition of the seed. New regions may be favourable to cotton-growing if man is willing to undertake all the costly and laborious task of irrigation: in this case, and subject to this condition, the yield may be more certain than anywhere else. To the list of those warm lands that are naturally suited to cotton-growing—India, Japan, the southern United States, and Brazil—there should therefore be added a second geographical group of irrigated areas with dry, warm summers—Egypt, the Turkestan oases, and the middle Niger.

(*C*) SOIL. Cotton is a very exhausting crop, requiring soil that is very rich, especially in phosphoric acid, and that must have its goodness restored. In India the soil formed by the surface disintegration of volcanic rocks—called *regur*, or *regar*—is entirely suitable for cotton. In the United States it is the richest soils that are used for this crop, and especially the high slopes or terraces of the Quaternary bed of the Mississippi, composed of very rich mud. Irrigated areas grow cotton particularly in zones covered by fluvial or fluvio-glacial alluvium.

(*D*) LABOUR. Cotton-growing calls for very meticulous and continuous care, alike for the preparation of the soil, for sowing, for watering in dry areas, and for the harvesting, especially in damp areas. It is thus dependent on the existence of a fairly large available population: there is no cotton-growing except where there is a dense population, as in India, Japan, the Nile delta, and the oases of Russian Turkestan.

Wherever the population was thinly scattered cotton-growing could develop only by the artificial settlement of new labour, such as the transport of African Negroes to the United States, the attempt to form a native peasantry in the Niger valley, and the immigration of Japanese into Brazil. Thus cotton was one of the fundamental economic causes, both directly and indirectly, of the slave trade, and of the establishment of slavery on a large scale in the southern United States, and the War of Secession was primarily a struggle for the labour needed for growing tobacco and cotton.

[1] F. Maurette, *Les Grands Marchés des matières premières*, p. 91.

WORLD PRODUCTION OF RAW COTTON
(*in Thousands of Tons*)

	1920	1936
United States	2914	2706
India	653	1144
China	408	849
U.S.S.R.	815	770
Egypt	271	424
Brazil	108	375
Mexico	—	78
Argentine	3	81
Sudan	4	52
Uganda	10	60

The total production of cotton in 1913–14 was 4½ million tons, and in 1938 it exceeded seven million tons. Although immediately after 1918 it might have been thought that the supply of cotton would soon be exhausted, and that the question of replenishing it would become a serious problem, the opposite happened since that date: production increased to such an extent, nearly doubling itself in ten years, that consumption did not advance at the same rate, and the accumulation of stocks caused a collapse of prices.

Any economic study of cotton should include also a second, and equally important, part—namely, a study of the principal industrial centres. Between the production zone and the industrial zone there was at one time complete separation. Cotton, grown in regions south of latitude 40° N., was until fifty years ago converted by industry into cotton goods in lands of European civilization alone—England, France, Belgium, Germany, Switzerland, Austria, Italy, Bohemia, and even the United States, where the industry was first established entirely in the eastern states, far from the centres of production. The main fact was the prodigious concentration of the cotton industry in and around Manchester. It was the raw cotton consigned to Manchester, as well as the exported cotton goods, that helped to make the fortune of the port of Liverpool. Thus for a long time Liverpool and Manchester were the predominant centres of attraction for cotton: it was to them that the cotton arrived from all quarters—from the United States, from Egypt, and from India.

But then a new era began. Spinning- and weaving-mills sprang up in increasing numbers nearer to the areas of production. They multiplied in the United States, in India, and in Japan, while the Soviet Union also developed its own cotton industry. This second phase in the history of cotton has a geographical character that should be set in very sharp relief, for the industries that have thus grown up have done so to an increasing extent within the range of the normal habitat of the cotton-plant; they too belong to zones that are warm, either naturally or artificially watered, and thickly populated. A new subordination of economic activity to geographical conditions has resulted from the development of this plant product.

United States cotton formerly dominated the market, and thus it came about that crises in that country immediately became world crises. The great problem is the adjustment of supply to demand, for it is disequilibrium in this respect that causes industrial crises and unemployment. The concern of other cotton-manufacturing countries was to ensure for the present, and still more for the future, a production of raw cotton that they could control and dominate. Great Britain, the country most interested and most threatened, developed cotton-growing in Uganda, Nigeria, Rhodesia, Nyasaland, etc., and made arrangements on a large scale for the irrigation of new areas in the Egyptian Sudan, with a view primarily to the cultivation of the cotton-plant. Plans are being made, and in some cases

are being carried out, for vast irrigation undertakings (the Niger, Cambodia, Syria, etc.) on the lines laid down by the English in the Anglo-Egyptian Sudan, at Gezira and the Gash river. But the first and most immediate hope lies in the organization and improvement of the cotton plantations in those geographical areas where cotton grows and ripens without costly artificial watering, because of seasonal rains and a sufficiency of labour already accustomed to fairly skilled agricultural tasks, such as Dahomey, Togo, Madagascar, and the New Hebrides.

The importance of the cotton industry in various countries is shown *approximately* by the number of spindles in use (on July 31, 1936):

Country	*No. of Spindles*
Great Britain	41,391,000
United States	28,157,000
Japan	10,595,000
Germany	10,109,000
France	9,932,000
U.S.S.R.	9,800,000
British India	9,705,000
Italy	5,483,000

An Animal Product associated with a Plant Product: Silk

Several species of *bombyx* make cocoons that can be unwound and provide more or less wild silk, but among them the *Bombyx mori*, or mulberry silkworm, is the one that yields the most valuable thread. Geographically, therefore, the distribution of silk production depends on an animal—the silkworm—and on a plant—the tree on which it lives and on whose leaves it feeds. The mulberry is on the whole a very adaptable and easy-going tree, thriving in northern latitudes—as in Norway and Northern Russia—as well as near the equator. Nor is it much more exacting in soil than in climate, for it grows very well on dry, flinty, or chalky slopes in the zone of the olive-tree. So if the matter depended only on the tree it would seem that silk could be produced anywhere from Norway to the Sudan.

But it is not enough for the mulberry-tree to develop in the normal manner. Its leaves must be early enough and plentiful enough to be supplied without delay and in great abundance to feed the voracious caterpillars of the silkworm. It is necessary as well for the climate to be mild enough for new leaves to grow, and for the tree to come to maturity. These things involve a very considerable reduction in the northward extension of the mulberry zone, for all the northern forest areas are quite definitely ruled out. Moreover, the climatic requirements of the silkworm itself are important in other respects. Where it develops in the open air it cannot stand a temperature below 59° F. during its period of growth and activity. This period, too, is a short one, lasting only about a month, and it is those lands where the spring period of the early growth of the mulberry-tree coincides with a warm climate that are suited to the rearing of the silkworm—namely, the moist regions of the Asiatic Far East (*i.e.*, the transitional monsoon zones—Japan, China, Tonkin, Annam, Cambodia, etc.), and the camellia zone (Upper Italy, etc.).

None the less even in these favoured places the chance occurrence of a lower temperature is enough to endanger the spinning of the cocoon, and as the critical period is so short it is customary to construct rearing-houses, called *magnaneries*, wherein a temperature of 77° to 86° F. is maintained during the early period, and one of about 68° F. in the following weeks. A period of twenty to twenty-five days must be allowed for the caterpillar to feed, and from four to five days for making the cocoon, so that this artificial rearing under human guidance lasts for a month. The silkworm has its diet of mulberry-leaves brought to it, and the 'climate' it likes is made for it. Now, since all this takes up

little space and lasts only a short time, such conditions could easily be provided several times a year if enough mulberry-leaves could be procured for successive broods of silkworms, and it would be possible, too, to rear silkworms artificially in any part of the world, provided once more that the mulberry-leaves were available and at the exact time of year when the creature was ready to begin its development.

Owing to these special conditions of culture 'under glass,' the geographical distribution of the productive silkworm, formerly strictly limited by climatic requirements, is now extended almost without limit, the only geographical limitation being no longer an animal one but a plant one. Sericulture has thus been enabled to leave its original home, the Far East of Asia, to get nearer and nearer to much cooler areas, and, finally, to become settled with great success throughout the entire Mediterranean region. The natural zones where the mulberry-tree produces leaves early enough and plentifully enough are all *possible* centres for the rearing of silkworms.

But at this point there intervenes another factor determining within these natural zones the actual points chosen for sericulture. This factor is the very one whose economic value and importance we have striven to show throughout these studies—namely, the quality and quantity of *labour*. For the domestication of the silkworm is, in fact, a task that calls for many hands and quick and skilful fingers. This kind of work, then, can be done only where the population is dense enough, and where enough hands are available at the precise time of year when the mulberry-leaves have to be picked and the silkworms fed.

In the Mediterranean lands the mulberry puts forth fresh leaves only once a year, and as a rule only one brood of silkworms is reared annually. There are some species of Bombyx called polygoneutic, because they can produce several broods each year, and these are reared, of course, in places where the climate allows the mulberry to produce leaves more than twice, such as Southern China, Japan, Tonkin, and India. In some of these countries as many as three, four, or five broods a year are reared. This brings some advantages from the standpoint of human labour, for the men and women engaged in the industry can give their whole time to it throughout the year. But in Syria, as in Italy and Provence, climatic conditions are such that the mulberry-trees produce leaves only once a year, so that extra hands are needed to rear silkworms. This limitation is neither an animal nor a plant one, but arises from the human population and the general work in which it is engaged.

It is observed by M. de Gasparin that in the South of France there is no desire for silkworms in those parts where large farms are the rule, because the agricultural population there is not numerous enough. The same applies also to regions given over to special crops, such as vines, olives, meadow-land, etc. Neither are lands cultivated by tenant farmers suited to silkworms, for the farmers dislike them, whereas the *métayer* is more readily interested in them. The rearing of the silkworm cannot be carried on with crop rotation, which calls for much work in the springtime. In short, large estates are generally incompatible with the silkworm industry, but on small ones it fits in admirably with all kinds of crops. To-day even in the small farms of Vivarais and the Cevennes the rearing of silkworms is rapidly falling off, on account of the general progress of agriculture and the introduction of more profitable crops.

There is another fact that shows the curious influence of the human factor on the geographical distribution of this industry. In the Far East the strict Buddhists—the followers of *Hinayana*, or the "Lesser Vehicle"—are forbidden by the teaching of their religion

to kill any animal, and are therefore opposed to the necessary suffocation of the chrysalis in the cocoon. So they form a barrier to the extension of sericulture, as do certain special climatic conditions, and a psychological fact in the sphere of religion is shown on the map of the world by a limitation of the distribution of a certain kind of stock-rearing.

Unlike the cotton industry, which until quite recently developed principally at a distance from the centres of cotton production, the silk industry sprang up first in or near the areas of production themselves—in China at a very early date, and comparatively recently in the Lyons region near to the *magnaneries*, or rearing-houses, in the Rhône valley. And, again in contrast to the cotton industry, there seems to be more and more separation between the production areas and those of the most marked industrial change, with the important exception of Japan.

The traditional and exceptional qualities of its workmen, as well as the feeling of security engendered by the very high standard of honesty of those responsible for grading the silks, caused Lyons to remain for a long time the world's chief silk market, though seriously rivalled by Milan, Zürich, and Crefeld. But a new industrial event came about—the creation of a silk industry in the United States. Backed by powerful capital resources and machinery of the most improved type, the city of Paterson, near New York, became the centre that supplied the world with the greatest quantity of silk, and New York became in consequence a very powerful importing market. The United States attracted and absorbed more and more of the raw silk of the Far East, and particularly that of Japan.

The rise of Japan to the front rank as a producer, and her development to an increasing extent as a manufacturer of silk, together with the fact that the United States has become a great industrial country, absorbing nearly all the silk exported by Japan—such are the two major facts that have swiftly and decisively changed the traditional geography of silk.

*Natural silk now has a dangerous competitor in the artificial product, officially known as *rayon*. This cannot take the place of real silk, but its consumption grows unceasingly because it is cheaper. It is a chemical product with plant associations, its manufacture being based on cellulose obtained from dividing the fibres of cotton or wood pulp, so it is free from all the risks of cultivation, and has won a place of increasing importance among chemical and textile industries. Though independent as a rule of all geographical conditions, the artificial silk industry has none the less drawn near to the chief existing textile centres, where it finds both experienced labour and consumption markets. Whereas in 1900 the world production of artificial silk was negligible (only 400 tons), it reached 69,000 tons in 1914, and in 1922 for the first time it exceeded the production of natural silk. It reached 451,200 tons in 1938.

PRODUCTION
(*in Thousands of Tons*)

Natural Silk		*Rayon*	
TOTAL (1937)	54·1	TOTAL (1938)	451·2
Japan (1937)	41·8	United States (1938)	117·0
China (1938)	3·9	Japan (1938)	96·5
Italy (1938)	2·0	Germany and Austria (1938)	65·0
Central Europe and the Balkans (1938)	0·427	Great Britain (1938)	48·0
Asia Minor and Central Asia (1937)	0·210	Italy (1938)	46·0
France (1937)	0·050	France (1938)	28·0
France (1938)	0·047	Netherlands (1938)	9·0
		Belgium (1938)	5·0

The production of rayon is nearly *nine times* that of natural silk—an economic fact that is not without significance.*

An Animal Product: Wool

Men in every age have conceived the notion of making use of the coverings of animals for their own clothing. But when you take an animal's fur you kill the animal, so the idea of using its coat without killing it led to shearing off the fleece. And then there remained to be solved the twofold problem of making the thread and weaving it. The natural fur of all hairy creatures can be, and has been, employed to make thread and woven fabrics. But the animal whose fleece is chiefly used by man is the sheep, which provides the wool that is made into so many kinds of fabrics, particularly cloth. So a geographical study of wool means a study first of the geographical causes of the distribution of sheep.

(*A*) Climate. The sheep feeds for the most part on grass, shrubs, and dry bushes. What suits it best is that bushy growth of lentisk, myrtle, etc., that covers the slopes and dry tablelands of the Mediterranean area, forming what are called *maquis* in Corsica, *garigues* in Languedoc, and so forth. Speaking generally for the world as a whole, we may say that the kinds of climate and vegetation found in the dry parts of the Mediterranean region are those best suited to sheep.

(*B*) Soil. The kinds of soil that grow this vegetation are stony, rocky, and often chalky ones, unsuitable for cultivation. (See Fig. 65.)

(*C*) Human Relations. Now, this natural vegetation is pre-eminently of a scattered character, and if sheep are content with a more than frugal diet they require, by way of compensation, very wide spaces when they are left to themselves to feed in the open, as is most commonly the case. Hence arises the imperative need for constant moves, and the long and regular journeys called *transhumance*, shown on the surface of the earth by those great traditional highways given up to the passage of flocks, called *drailles*, *carraires*, *tratturi*, *vias pecuarias*, etc.

But to make these great journeys possible the population must itself be very thin and scattered, so sheep-raising is the industry for very moderately peopled areas: a scanty population is one of the conditions required for sheep-raising. On the other hand, where there is a population of increasing density, and where, in consequence, the crops needed to feed these people are grown, the number of sheep diminishes, sometimes even to nothing. That is the primary fact of human geography, confirmed in many books, by observation, and by figures.

Engelbrecht's atlas of agricultural areas (*Landbauzonen*) shows us, both for the Old World and for America, the progressive decline of sheep-raising as the population increases in density. From these maps, based on statistics, it can be seen how in the United States the sheep have been driven, decade by decade, from the eastern states to the dry, mountainous, desert regions of the Far West.

There were more than 32 million sheep in France in 1840; 29½ million in 1862; 24 million in 1882; 21 million in 1892. The total fell even below 18 million in 1905, and to 10 million in 1939. Thus in a bare century the French sheep population was reduced by two-thirds. And similar details collected from other countries would confirm this law.

So far we have considered the sheep as supplier of wool. But that is by no means the whole story.

Ewes give milk of good quality which is made into some very famous kinds of cheese, such as Roquefort. The sheep is bred also for its meat, thus bringing into operation an entirely different set of geographical conditions, needing separate analysis, especially since for meat production we have to go to the *English* breeds of sheep (in England and Normandy), which are particularly averse to

drought, heat, dust, and long journeys. "The cultivation of the soil, far from eliminating these breeds of sheep, facilitates their rearing, with the assistance of industry. Clover, lucerne, tares, beetroot, cake made from the oil of sesame, cottonseed, or ground nut (arachis), and especially sugar-beet pulp—all these foodstuffs are lavished on the sheepfold, for the sheep is scientifically fed so that the production of mutton is almost an industrial matter."[1]

If, bearing this in mind, we examine the distribution of wool-producing sheep, we find that it is determined on the whole by extremely simple geographical principles. Sheep are found in all the dry, bleak, little-cultivated, and sparsely inhabited parts of the entire Mediterranean region. The dry zone, so well suited to sheep, extends eastward from the Mediterranean across South-eastern Russia and the Khirgiz steppe as far as Mongolia, and farther south beyond Asia Minor to Iran and the dry parts of Northern India. In North America we find a strikingly similar region, naturally suitable for sheep—the so-called 'arid region' in the west—as well as the lofty Mexican tablelands. So, too, in the Southern Hemisphere dry zones more or less resembling the dry Mediterranean lands reappear in the Argentine, in South Africa, in Australia, and in New Zealand. Similarly, also, sheep-rearing on a large scale is carried on in these four countries, which have the great advantage, so far as sheep are concerned, of possessing vast open spaces very sparsely inhabited.

APPROXIMATE NUMBER OF SHEEP

(Countries grouped geographically)

	About 1900		1910	1930	1937	
	Million Head	Per 100 Inhab.	Million Head	Million Head	Million Head	Per 100 Inhab.
Mediterranean countries:						
French North Africa (including Morocco in 1930 and 1937)			11·0	18·1	20·00	128
Spain	16·5	88·5	14·0	20·0	19·00(1933)	76
France	19·5	50·5	17·8	10·1	9·99	24
Italy	7·0	21·2	7·0	9·8	9·09	21
Hungary	8·0	42·2	8·0	1·4	1·40	1
Greece	3·0	119·4	3·0	6·7	8·40	120
Serbia (Yugoslavia in 1930 and 1937)	3·0	121·0	3·0	7·9	9·50	63
Rumania	5·5	92·8	5·5	11·9	11·80(1935)	61
European Russia	52·0	50·0	44·0	89·8	66·60	47
Turkey (Asia and Europe)					16·40	102
Climates similar to Mediterranean or slightly wetter or dryer:						
United States	62·0	81·3	51·0	52·7	53·70(1939)	41
Uruguay	18·5	1038·8	18·0	20·5	17·90	895
Argentine	74·0	1814·0	67·0	44·4	43·70(1938)	352
South Africa	12·5	520·0	15·0	45·0(1929)	39·80	463
Australia	92·0	2028·0	84·0	106·3	109·30(1939)	1607
New Zealand				30·8	31·30	2006
Wetter countries:						
Germany	9·5	17·2	7·7	3·5	4·60	6
Great Britain and Ireland	31·0	74·4	29·0	24·6	25·50	51

[1] L. Perruchot, "Le Mouton de France et ses produits," in *La Géographie*, vol. xx (1909), pp. 361 and 560.

The largest sheep population in the world is that of Australia. It is essentially the creation of man, for it was in 1795 that an English captain took with him a few merino rams and ewes when he went to settle in Australia. That was the beginning, only 150 years ago, of a flock that reached in 1891 the formidable figure of nearly 110 million head of sheep. Repeated droughts during several years reduced this number to 50 million, but in 1933 the total was 114 million, and in 1939 110 million. If we add the figures for the neighbouring Dominion of New Zealand we can visualize what they mean—the close-packed, restless, bleating flocks, amounting to 140 million sheep, on an area rather less than that of Europe, but with a human population of only ten millions. No other example could show more plainly to what an extent and with what speed the animal world can be conquered by human power, and how the systematic will of the stockbreeders can, as it were, spread over a country in a few years a vast multitude of new domesticated animals. (See Fig. 95.)

A New Aspect of the World Wool Problem: The Influence of Labour Peculiarities in Large-scale Industry on Production at a Distance, and the Part played by the Great Markets

Wool production has passed through various well-marked stages. In the Middle Ages the producing countries were Champagne, Picardy, Les Causses and the Black Mountain (the Cevennes), Flanders, England, Germany, and Spain, while the principal manufacturing centres were Bruges, Ghent, Rheims, Troyes, Amiens, Mazamet, and to some extent the Rhineland and even Switzerland (the cloths of Basle and Fribourg). To-day we are much farther removed than one might imagine from the situation even of forty years ago, when the wool-producing lands were dependent on a single great wool market—that of London. Now, as the table above shows, it is the Southern Hemisphere that provides most of the raw material.

Australasian methods, too, have won predominance: the transhumance of the Mediterranean, and even of the Argentine, type has been replaced for the most part in Australia and New Zealand by the 'folding,' or 'enclosure' system. And since 1922 the London Wool Exchange in Coleman Street has no longer been so exclusively the principal centre of the wool trade as it was before. For, in the first place, all the manufacturing centres have tried to ensure their supplies by appointing brokers and buying agents in the Southern Hemisphere, and have received their raw material at the ports that suit them best; and, secondly, the producing countries have themselves established manufactures (for example, the Argentine and Australia). The United States, itself a producer of wool, has developed its woollen industry to such an extent that it was already suffering from a slump in a time of general prosperity.

The characteristic feature of the period 1920–39

> is the existence of two groups of quite separate markets: the great wool-producing and exporting countries on the one hand, and, on the other, the countries which, though producing raw wool, consume far more than they produce. . . . The manufacturing countries of Europe manufacture about ten times as much wool as they produce.[1]

We remarked earlier on the need for a distinction in the old geography of sheep-farming between the wool-producing and the meat-producing varieties. But the increasing industrialization of sheep-rearing, and the very rapid progress made in the organization and methods of *cold storage*, have led the sheep-farmers of the Southern Hemisphere to attach more and more importance to a breed of sheep that can serve both the wool-merchant and the butcher. In many places the merino sheep, which always grows the

[1] From an article in *Études et information commerciales de la Banque nationale française du commerce extérieur* (May 18, 1923), p. 149.

finest wool, has been given up in favour of a cross between the Spanish merino and the English breed, producing what is called crossbred wool. In Australia, as well as in the Argentine and New Zealand, these crossbred sheep have been introduced for the production of mutton, but as they need more water than merinos the arid land of Australia will always be compelled to pay more attention to the latter.

Soil and climate, then, and especially climate, still explain the general distribution of the chief sheep populations of the world. But the human element plays its part as well. The industrial destination of the flock has an effect on its character, for it is man's own ends—those of the most highly civilized human beings, with the widest range of wants—that influence, though from a distance, the selection and the qualities of the beasts that are bred for his service.

The principal wool-exporting countries in 1937 were Australia (319,000 tons), the Argentine (115,800 tons), the Union of South Africa (107,500 tons), New Zealand (128,000 tons), England (120,600 tons, including re-exports), Belgium and Luxembourg (41,200 tons), and France (31,300 tons). The exporting countries have special wool ports—Buenos Aires, in the Argentine (and a secondary one at Santa Cruz, in Patagonia); Montevideo, in Uruguay; Cape Town, in South Africa; Brisbane, Sydney, Melbourne, Geelong, and Adelaide, in Australia; and so forth.

There is a growing tendency for manufacturers to obtain their raw wool direct from the producing countries without recourse to intermediate markets. Thus the industrialists of Roubaix and Tourcoing not only employ permanent agents in the Argentine, Uruguay, etc., and have branches in Italy, Poland, and the United States, but they have even become creators and owners of flocks themselves by setting up as sheep-farmers in the French colonies.

The area of production, the wool markets, and the manufacturing centres have become bound more and more closely together by the development of transport, and in a general study it would be a mistake to separate them. A critical geographical examination of the woollen manufacturing industry has therefore a legitimate place in this preliminary study of 'essential facts.' What is called economic geography is a kind of normal expansion and indispensable complement of that human geography which is in truth the primary and fundamental geography, and we are pleased to have once more demonstrated this truth.

The geographical account of wool, however, is not all comprised either in these pastoral phenomena of modern sheep-farming in new countries or in these economic facts concerning the greatest industries of to-day. For there still remain certain ancient and traditional industries of a special kind, always directly connected with sheep-flocks in the Old World, and with the way of life imposed on men by the system of transhumance. Such, for example, is the making of carpets. Even to-day in the Balkan countries, in Anatolia, in Syria, and in Turkestan, as well as in the sheep-lands of North Africa, there is skilled craftsmanship at work, carrying on the traditional methods by which these native products become unique luxuries, much sought after in the most highly industrialized lands. And even to-day, too, the great nomadic sheep-owners of the Iranian tablelands journey from north to south, and then northward again, leading and following their huge flocks of sheep, and taking with them their primitive industries, whereby during the evening halts and the longer seasonal ones they continue to work with patient and laborious care at their splendid Persian carpets. What geographer will draw for us a general picture of the conditions of production and labour involved in hand-wrought woollen fabrics such as these, completely unknown to the vast, sheep-filled open spaces of the Southern Hemisphere?

Other geographers will arise to follow the example set by the young investigators already quoted, or yet to be quoted, in dealing with the geographical conditions of the

source and treatment of all the principal products of economic life in new and more synthetic ways, by a kind of intellectual integration akin to what is called integration in the industrial sphere.

Fats and oils, of plant and animal origin, which are in ever-increasing demand, and competing with each other more and more on the chief markets, would be a very fruitful field of study in human geography. They include the fats of the Southern Hemisphere and the United States, the white vegetable fat of China, fish oils, and all the vegetable oils, old and new—olive, linseed, colza, castor, soya, ground nut, palm, palmetto, copra, maize, cottonseed, and so forth.

The strictly geographical examination of all these products always leads eventually to observation of ways of life. So let us proceed now to follow the great journeying sheep-flocks.

6. Pastoral Nomadism

Typical Forms, Varieties, and Attenuated Forms (*Semi-nomadism*)

The forms of human activity connected with sheep-rearing undoubtedly deserve particular attention as phenomena of human geography. We are all familiar with the life and the great migrations of the mounted shepherds of Central Asia and the caravans of the camel-riding shepherds in the deserts of Arabia and North Africa.

The horse is pre-eminently the animal of the wide, grassy steppes, as the camel is of the xerophilous vegetation of the desert lands of the Old World, and where these two great natural divisions meet they encroach on each other's domain as riding and transport animals. The horse too, a domesticated animal in close association with the life of man, is connected with the most advanced forms of contemporary civilization and useful for many purposes. As for the ass, it is an excellent beast for the dry parts of Africa, and in its original environment it has kept its better qualities—strength, endurance, and agility.

In regions where the horse cannot stand too rigorous temperatures, as on the extreme margin of the great northern forest, its place is taken as a beast of burden and a source of nutriment by the reindeer in cold regions in high *latitudes* and the yak in cold regions at high *altitudes*.

The fact that horses cover the ground so swiftly has made conquerors of the mounted shepherds. From Western Asia the horse was introduced into Egypt, and spread throughout the Mediterranean area and the adjoining parts of Europe and Africa. Even to-day the zone in which the horse predominates not only includes China, but extends from Manchuria and Mongolia as far as the western end of the African Magrab.

But the whole of Southern Asia and the Far East, the monsoon area, is still the realm of the ox, or, more precisely, the bovine species. (See Fig. 85.) Oxen are still man's principal transport assistants in Tibet, China, Indo-China, the Malay Archipelago, Burma, Siam, India, and Ceylon, whether they be yaks, bullocks, humped oxen, zebus, or buffaloes. Oxen are slow and ponderous servants, but easy to control. In our own times and in our own lands of Mediterranean culture—Spain, the Basque countries, the whole of Southern France, and Italy—a very important part is still played by oxen as beasts of draught and burden. I remember during the Balkan wars of 1912–13 meeting on the roads of Macedonia and Old Serbia (Kossovo and Metokia) endless convoys of military supplies, all of whose vehicles, in detachments of 150 to 200, were merely carts drawn (very slowly!) by pairs of oxen, especially buffaloes.

There are some lands where beasts of the pig and goat species are reared on a large scale, but in our old lands of Mediterranean culture they are frequently kept in small and isolated groups, the companions, as it were, of the humblest peasants, so that from this point of view they call for social rather than geographical study. Poultry-rearing is similarly a too general feature of human geography

not to attract the attention of some young geographical observers. But it is none the less true that most domesticated animals are reared in flocks or herds.

Since sheep have been given most attention here as a typical example of the herd or flock it will be as well to give rather closer examination, in connexion with sheep, to the subject of human movements.

E. de Martonne has collected some characteristic features of this form of nomadism in an article on pastoral life and transhumance in the Southern Carpathians and their geographical and historical importance. The Southern Carpathians, and particularly the Paringu massif, are one of those highland regions whose mountain-tops, given up to pasturage above the upper forest limit, are inhabited by the greatest number of flocks of sheep, at all events during the 'summering' season. The author has marked on a small map the chief routes along which the periodical movement of the sheep takes place, bearing the expressive name 'sheep roads' (*drumul oilor*).

These are typical examples of transhumance, but besides the typical ones there are many intermediate ones to be mentioned.

Just as in the preceding chapter we showed the close association existing between the house and the street or road, so it should be noted that the phenomena of cultivation and of domestication are very often closely intermingled. The difference between the husbandry of the spade (*Hackbau*) and that of the plough (*Ackerbau*) is simply the difference between working the soil by human labour with hand tools (spades, mattocks, etc.) and doing it with the help of trained and domesticated beasts, like oxen, horses, buffaloes, camels, etc.

It would be a mistake, however, to regard nomadism as exclusively a feature of the pastoral craft. The man who has to follow the movements of his sheep, horses, oxen (see Fig. 94), or camels because he is in charge of them moves himself when he moves them in search of fresh pasturage, and there is therefore a connexion between this form of labour and nomadism. This is not the only example, however, and we shall return to this important subject in the next chapter.

Even in lands where nomadism is a dominant feature there are many examples of semi-nomadism, representing a more or less close intermingling of cultivation and stock-raising. It is many years now since I was struck by these complex phenomena after journeying over the lofty Algerian steppes and the Northern Sahara, and I made careful observations like those made by Masqueray in connexion with the semi-nomads of the Aurès massif in Algeria.

To realize the complexity of nomadism one should first read the book by Augustin Bernard and N. Lacroix on the development of nomadism in Algeria. Nothing could be further removed from a deductive and purely theoretical treatise than these three hundred well-documented pages, telling us what nomadism is, the conditions under which it exists, the developments it has undergone and may undergo in the future, and the various factors which cause it. For it must be admitted that those who have dealt with this subject have often done so in far too superficial a manner.

For some such writers nomadism is merely one stage in the progress of the human race: man was first hunter, then shepherd, and finally cultivator of the soil. For others it is primarily a matter of race: the Arab, for instance, is a nomad, and can be nothing else. They have forgotten that in French North Africa, along with the nomadic Arabs, there are many nomadic Berbers. Presented thus, these two solutions have one grave defect: they ignore either the restrictive influence of Nature on human activity, or the way man adapts himself to geographical conditions, or, again, the political factor that results from man's own will.

Nomadism on the lofty Algerian tablelands is, of course, "a periodical and regular migration necessitated by the pastoral industry."[1] It is the movement at fixed and regularly recurring periods, not merely of individuals, but of an entire tribe, actuated by the need for fresh pasturage for flocks that procure their own food and provide a living for the tribe. It is by no means the case, however, that there is a single type of nomadism for a whole territory. There is a series of intermediate types, ranging from the inhabitant of the Algerian Tell on the one hand (who is primarily a cultivator, and feels little need to move because the soil is rich enough to feed him and his flocks all the year round), to the Chaamba and Touareg on the other (for whom transhumance is now scarcely necessary, as they no longer have any large flocks). Between these two cases come the real nomads, who live by rearing their flocks, and for whom nomadism is a necessary effect of geographical conditions.

That point, in fact, is made abundantly clear in the work just mentioned. The utilization of the soil under the special form of nomadism is the only possible method on the high tablelands of Algeria—that is to say, throughout the whole area between the Tell Atlas in the north and the Saharan Atlas in the south—because this region cannot be anything but a steppe. Cultivation, indeed, could be carried on only by means of irrigation, and then only on a very restricted scale. The north, bordering on the Tell Atlas, receives mainly spring and summer rains, while the rainfall in the southern, or Sahara, region comes in the autumn and winter, so that certain tribes are obliged to have summer and winter encampments—sometimes even spring and autumn ones—and to practise regular and periodical migrations.

The more populous the tribes, and the richer they are in flocks, the greater is their desire to extend their grazing-land. But to reach the various encampments from time to time the flocks need ground to travel over, and this is bound to be burdened with certain customary tolls: a hundred thousand sheep cannot be moved from the Sahara to the Tell in the twinkling of an eye or without demanding water and grass.

If in any year the steppe suffers considerable injury from irregularity or insufficiency of rainfall the tribesmen are naturally tempted to overrun the boundaries of the cultivated land rather than leave their flocks to perish, since these are their only wealth. And here a new difficulty arises: to abandon the forested reserves to sheep or goats is to destroy them—to continue that deforestation that has already done far too much harm to Algeria. On the other hand, "the extension of cereal-growing is unfavourable to the rearing of sheep by causing the undergrowth to disappear."[2] And so there tends to be formed a strip of land between the genuinely cultivated areas and the pasture-land, which becomes more and more infertile and impoverished in years of deficient rainfall, when it is good for neither cultivators nor shepherds.

It is surely not necessary to condemn several hundred thousand sheep to death in order to produce a few bushels of wheat, and that only in the most favourable years. Cultivation cannot go on indefinitely gaining ground in Algeria. This was asserted some years ago by Schirmer and myself, when we noted that in certain oases it has extended as far as it is capable of doing, and that the desire to develop over still greater areas means condemning it to death where it is now alive: new areas are almost always fed at the expense of earlier ones. Bernard and Lacroix are entirely of the same opinion. So their conclusion is understandable: "We must wage war on any solutions of too absolute a kind, and beware of believing in the intrinsic superiority of cultivation over stock-raising, not forgetting that the part it plays in the steppe, while to some extent increasing, can never be anything but a subordinate one." And, again: "Have we any right to condemn nomads to perish of hunger and make the whole of the steppes unusable and unproductive in order to grow wheat where climatic conditions do not allow it to grow? Still less should we permit European or native cultivation to

[1] Bernard and Lacroix, *L'Évolution du nomadisme en Algérie* (1906).

[2] *Le Pays du mouton*, p. 47.

cause injury to the sheep-farmers when this injury is not counterbalanced by any real advantage or genuine economic interest."[1]

Looked at from this point of view, and considered as a matter of climate, nomadism as a whole could be regarded as unalterable, and it would therefore be right to conclude that the Algerian tablelands can never be the abode of sedentary tribes, for the relief and climate of these regions are hardly likely to change. But this immutability of nomadism is not complete, for during the last few years some changes have taken place, and are even tending to become more marked. What, then, are the influences responsible for this development?

This problem needs to be very closely examined. In North Africa nomadism originated, as we have said, in pastoral activity. But have not other factors—subsidiary ones, perhaps—played their part also in the extension of certain forms of nomadism?

It is well known that the nomad, though a shepherd, is an astute merchant as well, and that the great caravans of camels that travel between the Sahara and the Tell are the principal means of conveying dates from south to north and cereals in the opposite direction. It is well known, too, that the fine barley-fields and verdant gardens of the oases are very likely to tempt the nomad when he compares them with his own barren steppes, growing nothing but coarse tussocks. Such things are common to all regions bordering on deserts. The Turkmenians of Central Asia were as great a danger to the Iranians as the sand of the neighbouring solitudes, and the Mongols often invaded the rich cultivated lands of China and India, impelled by that instinct of pillage too long inherent in the character of nomads. Though the geographical factor is at the root of nomadism, the human element has found it possible to extend and accentuate it. Might it not also restrain and weaken it?

On this subject history provides a series of incontrovertible facts. Territories that to-day are swarming with nomads or invaded by the sands of the desert were formerly occupied by sedentaries and used for cultivation. Before invoking climatic changes—always very questionable, at least so far as historic times are concerned—to explain these changes, we should see whether they cannot be just as well attributed to warfare and the ravages and destruction that it normally brought in its train.

Owing to the protection afforded by the Roman armies, cultivation drove back the nomad and gained ground, without, however, reaching the steppe regions that extend to the south of Algiers and Oran: the nomads kept their footing south of the Romanized areas. On the decline of the Roman power the agriculturist was in turn driven back by the advance of the nomads, which, though stopped for a short time under Byzantine rule, started again with the Arab invasion of the seventh century. It has been thought by some authors that this invasion flooded these regions with a nomad population, but it was rather the invasion of the twelfth century which established some 500,000 nomads in these parts, thus adding to the evils of war the evils arising from their habits and manner of life: "It was their sheep, their camels, and their goats that ruined North Africa."[2] Later on the Turkish Government was unlikely to encourage agriculture: why should it bother, if at harvest-time the crops were bound to be carried off by brigands from the desert or from Algiers?

A no less disastrous consequence, the absence of a sedentary population, also had ruinous effects on cultivation, for it is a matter of observation that must never be forgotten that

> in dry lands, like the Mediterranean countries, and even more in the steppes and the Sahara, there is no need of *positive* injury to cause the soil to deteriorate, the forest to perish, and the

[1] Bernard and Lacroix, *op. cit.*, p. 63.
[2] Bernard and Lacroix, *op. cit.*, p. 26, and see below, Chapter IX.

nomads to gain ground, for negative action is sufficient: it is enough to do nothing, not to undertake irrigation work, and to take no interest in water or forest.[1]

And the same applies to many other countries also. On the other hand, the sedentary, feeling himself protected, will no longer be afraid to extend his cultivation as far as climatic conditions allow. He will resume the land he had abandoned, and we shall witness in consequence an apparent withdrawal of nomadism.

On the edge of the Syrian desert, when I visited it in 1921, I could see things which provide remarkable confirmation of what has just been said. Fifteen years earlier the Turks had established a sort of fortified camp in a region of general nomadism, well to the east of the Coele–Syrian railway from Homs to Aleppo and north-east of Hama, and the security afforded to persons and goods by this supervisory and protective post led to the spontaneous formation of a score of villages inhabited by semi-sedentaries. But when the 1914 War came and the Turkish post was evacuated more than half these experimental villages, as they might be called, ceased to exist.

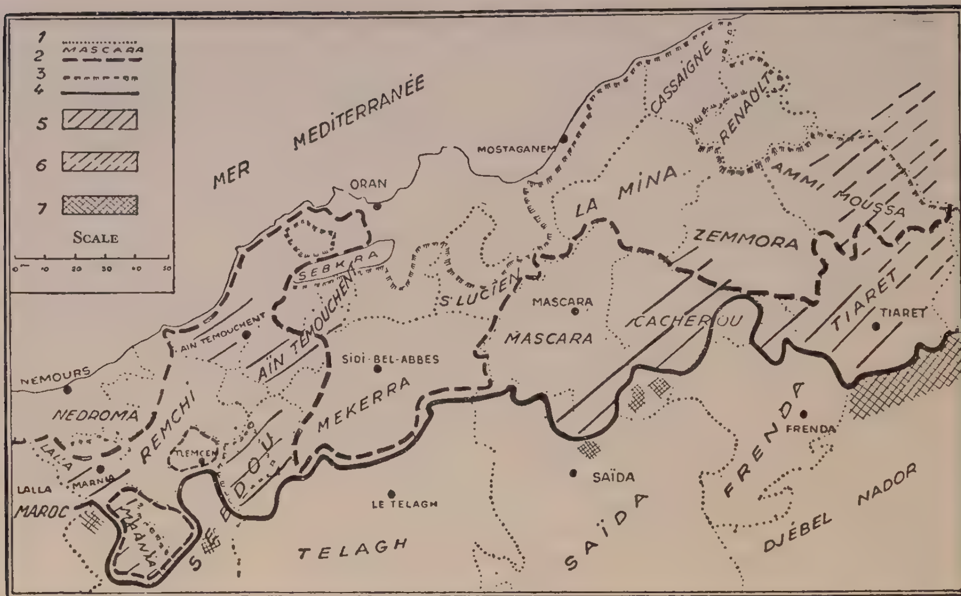
Halfway between Homs and Hama, too, and particularly around Aleppo, the great terminus and market for the desert nomads of a vast network of caravans, one finds a series of villages whose inhabitants are half nomad and half sedentary, but have most of them become almost completely sedentary. These are very curious villages in the vast intermediate zone whose soil is rich enough and sufficiently well watered by scanty winter and spring rainfall to be tilled and produce cereals. Much of this cultivated land belongs to tribes of transhumant nomads who leave a few permanent 'working-parties' on them. It is therefore pre-eminently a zone of contact between nomads and sedentaries, and of transition between cultivated land and areas of passage. The villages of these semi-nomads, so characteristic and picturesque, may be regarded as well on the way to becoming completely sedentary. (See Figs. 106 and 107.)

But, despite all this, is the decline of nomadism on the Algerian tablelands a mere surface phenomenon—a restriction of the areas of passage—or does it imply an essential alteration in the way of life of the nomads or semi-nomads? The observations of Bernard and Lacroix indicate not only a decline in nomadism, but a transformation, a genuine process of development, and a real phenomenon of social geography.

The existence of the nomad or pastoral farmer is bound up with that of various kinds of animals, and there is a whole series of transitional groups between the breeders of cattle and those of camels, horses, goats, or sheep. The horse is essentially a creature of the grassy steppes, and the task of rearing it in such dry areas is not without its difficulties and risks. The French occupation and consequent pacification of the country have led to doubts as to the wisdom of retaining an animal that is dearer to buy, expensive to keep, and no longer performs the services expected of it. So the breeding of horses has diminished, while that of mules has increased.

There has been a change, too, in camel-rearing. This creature is specially adapted to the desert, and plays an important part as a pack animal as well as for riding. But owing to the use made of the camel by the Algerian troops, the flocks of camels have been terribly diminished, to such an extent that the effective number fell from 255,000 in 1896 to 187,000 in 1901. This mortality, aggravated by drought and the hard winter of 1903–4, raised the price of camels, and though subsidies were paid by the Government towards reconstituting the herds, many of the natives bought sheep, and even cattle. With regard to the reason for this, it is interesting to read the reports of officers on the subject: "Now that insecurity has been brought to an end in the district of Marnia the native is no longer obliged to pack up quickly and flee from his swift and numerous enemies, so his camel is of less use to him." And, again: "In the district of Mecheria the camel's usefulness to the natives is less because they do less and less moving, and the railway is competing with caravan transport." In other desert regions, or on the fringes of the desert, and where, therefore, great migrations are essential, camel-rearing continues, and could not be neglected.

[1] Bernard and Lacroix, *op. cit.*, p. 29.



Map XXVII

How the Huts of the Sedentary or Semi-sedentary are driving back the Tents of the Nomads in Oran (Algeria)

Key

1. Boundaries and names of mixed communes.
2. 1911: northern limit of zone where tents were predominant.
3. 1911: limit reached by tents mixed with fixed dwellings.
4. 1936: limit of area where tents were predominant and almost always the sole form of dwelling.
5. 1936: tents mixed with fixed dwellings.
6. 1936: tents used as summer dwellings.
7. 1936: fixed dwellings in the tent area (often unoccupied for the whole or part of the year).

The development of an 'essential fact' of human geography, such as the human dwelling, expresses a profound social and economic transformation in the country.

*From Larnaude, "Tentes et habitations fixes en Oranie"**

Here, as on the edge of the Syrian desert, is shown the influence of man himself as a geographical factor. The security enjoyed by sedentary peoples, the construction of railways, and the organization of regular motor services have taken from the camel almost all its usefulness on these tablelands, whether as a pack animal or for military purposes, and it is giving way to the sheep, which is the true creature of the Algerian steppe. Care must be taken, therefore, not to prejudice the extension of sheep-farming by too restrictive measures against stock-raising or too much protection of cultivation. The best policy, according to Bernard and Lacroix, would be, not to sacrifice the tilled land or the forests, but to substitute intensive for extensive stock-raising by dividing up the pasture-land, creating water-points, and making better use of existing resources. "Irrigation works in the valley of the Murray in Australia have made it possible to grow lucerne there, and owing to this plant 15,000 sheep can be fed on 200 acres, or 75 to the acre, whereas formerly in the same country five acres were needed to feed five sheep."[1]

Another factor that is in course of modifying the very nature of nomadism is the

[1] Privat-Deschanel, "La Question de l'eau dans le bassin du Murray," in *La Géographie*, December 15, 1905, p. 466.

commercial one, or, rather, the changes that it is undergoing. It was formerly necessary to organize great caravans to carry to the markets of the Tell the flocks, their wool, and, generally speaking, all the produce of the sheep-farmer, in order to take back grain and sundry manufactured products. But to-day the roads and railways, owing to the greater security enjoyed by the country, have penetrated even beyond the edge of the desert, facilitating the establishment of depots, trading-places, and commercial centres. Similar developments are taking place elsewhere under the influence of the same factors. The great traditional caravan routes are gradually disappearing with the coming of the motor-car and the railway, commercial centres are changing their places, and the great annual fairs are giving way to markets held more frequently.

When stock-raising develops, and when commercial habits and industrial techniques develop too, the social organization is itself affected, and that is the extent of the indirect influence exerted by certain human and political factors. That there are profound developments going on among the nomads of Algeria is a fact that can no longer be denied. They include

> a tendency to reduce migration, a decline in the rearing of camels and an increase in that of cattle, an extension of cultivation, a tendency to build houses, to greater luxury, and to more individualism within the family, and the freedom of the family and the *douar* or encampment in relation to the tribe.[1]

These changes appear much more clearly in some semi-agricultural tribes in the region bordering on the Tell (see Map XXVII) and on the edge of the steppes; they have had less effect on those dwelling right in the Sahara. In other words, progress is specially marked in regions where nomadism owed its existence and its growth to factors which were undoubtedly geographical, but to a large extent also to human ones, such as the insecurity of the country and the sparseness of the population. Development is much less pronounced in places where nomadism results mainly from strictly geographical conditions. Yet even in such places its manifestations are numerous enough to justify us in saying that nomadism is not a matter of race, is not of a single type, and is not unalterable. On the other hand, the resistance that it offers to any too rapid changes is sufficient indication that it is founded on natural conditions that are hard to alter.

7. Animal Transhumance does not necessarily imply Human Nomadism

Nomadism and Partial Migrations

Transhumance of large flocks of sheep takes place in all the lands surrounding the Mediterranean. But the fundamental difference between transhumance in Africa and in Europe is that the former involves true nomadism—*i.e.*, the removal of the whole tribe —while the latter, apart from very rare exceptions, means the movement of animals under the guidance of a small number of shepherds only. It is true that in the case of an elaborate organization like the Spanish *Mesta* a regular hierarchy and regiments of drovers were needed to drive the hundreds of thousands of beasts from north to south and back again by the three great cañadas, or valley roads, reserved for the flocks and herds —*Leonesa*, *Segoviana*, and *de la Mancha*. But even then there was no mass migration of the communities of men who made a living out of this living wealth: there was no nomadism

[1] Bernard and Lacroix, *op. cit.*, p. 302.

in the strict sense of the word. Moreover, even that relates to the past; in most of the European Mediterranean countries not only is nomadism a rare exception, but, owing to causes belonging to human geography that were noticed at the beginning of our study of wool, the transhumance of flocks of sheep is itself declining.

Never and nowhere has transhumance of sheep been connected with a social, economic, and political institution so extraordinary and long-lived as it was in Spain during the five and a half centuries of the famous *Mesta* (1273–1836). A very scholarly history of it has been written by Julius Klein, from which Maximilien Sorre has extracted the essentially geographical points. The Mesta, according to Klein, has had a marked effect on the social and economic organization of the Spanish people, and even on the appearance of the peninsula. Its long centuries of activity in the agrarian life of Castile aggravated the injurious conditions of deforestation, rural depopulation, and agricultural stagnation. Sorre, following Klein, noted that there are two periods in the history of the Mesta. Up to the beginning of the fifteenth century some measure of equilibrium seems to have been established between extensive, transhumant stock-raising, stationary stock-raising, and cultivation. But when, in the seventeenth and eighteenth centuries, the agricultural transformation of the peninsula began to take place agriculture reacted, and "the Mesta appeared as an obstacle to agricultural progress and a cause of deforestation." There was strife also between the transhumant and the sedentary sheep-breeders. In short, in 1786 the Mesta's rights of possession were abolished, and the very name 'Mesta' disappeared on July 31, 1836.

At the beginning of the twentieth century conditions were quite different. Some illuminating facts and figures concerning the most recent changes in transhumance in Spain were published by André Fribourg in 1910. The sheep at that time, he says, were conveyed in railway-trucks. In Spain, as in many other countries, sheep-rearing involves less and less transhumance. Whereas in the fifteenth and sixteenth centuries there were some 3,000,000 sheep on the move, at the end of the nineteenth there were only 1,355,000—a small fraction of the entire Spanish flock.

Sorre has described the biological plant conditions and the great diversity of 'ways of life' in the Eastern Pyrenees. In the Garroches (Upper Conflent), for instance, where human life is more difficult "than in any other Mediterranean district," it is maintained by taking the flocks down to the plains in winter. Ampurdan and the Garrotxa of Ampurdan are reminiscent of Lower Languedoc in the eighteenth century—"the same alliance between poor agriculture and the breeding of sheep which are given the task of fertilizing the waste land," and so forth.

Sorre concludes as follows: "Sheep-rearing was an essential part of each of the units we have studied, the periodical movements of the flock being the bond of union between them. This strong bond has helped to keep the manner of life from changing. But when this way of life on the plain began to develop there was a feeling that the harmony was broken, and hence arose the efforts of the French cultivator, in Roussillon as well as in Languedoc, to free himself from the collaboration of the shepherd. And the bond was loosened at the same time by the progressive decay of sheep-rearing. It may be forecast that a new equilibrium will be established, based this time on the raising of cattle."

Cattle are already appearing in these parts of the Mediterranean Pyrenees, but it is particularly in the Alps that cattle-rearing is continually improving and developing. The southern part of the French Alps still belongs, by its nature, its vegetation, and its economic activity, to the realm of the sheep. Yet that is only a small part of the vast mountain region, stretching in France as far as Lake Geneva, which continues through Switzerland, Italy, Bavaria, Slovenia, and Austria, as far as Vienna, and remains for the most part a cattle region. It is remarkable that the very word *alp* means a mountain pasture where flocks are taken to graze during the summer.

Arbos studied the two zones in the French Alps—the sheep zone and the cattle zone. One of his two coloured maps gives a striking impression of the difference between these two Alpine regions. In Savoy, the Grande Chartreuse massif, and Vercors the number of sheep is always less than that of the cattle, while elsewhere it is ten times as great.

The kinds of Alpine pastoral life connected with cattle, and in a much less general way with sheep, "keep the cattle within the mountain region and transfer them from their winter quarters to their summer ones without moving them far. But for sheep there are also migrations of a different kind, for among the flocks that spend the summer on the mountain pastures there are some that winter in the plains surrounding the great mountain-range. These are transhumants whose original home is Lower Provence, but which cannot live there in the warm season when insects abound and vegetation is checked. Nearly 300,000 sheep winter in the Arles region, looked after by shepherds. They stay from November to the end of May on Camargue and the Crau plain, cropping the *coussous* of the Crau and the *enganes* of Camargue. Then they get on the move and go off in search of food and coolness in the Alps. Most of the ancient transhumance routes have been abandoned, and no longer can we see flocks of 20,000 sheep advancing on the same road, as we could once. Transport to-day is carried on as far as possible by rail."[1] And once unloaded the flocks move between several pastoral sites, going higher as the snow melts.

"Alongside of this *normal* transhumance there is also an *inverse* kind practised by some Alpine breeders owning numerous flocks or herds which the high pastures suffice to feed in summer, but which could not be kept in the mountains in winter for want of food. Thus the cattle of Alpes-Maritimes spend the winter on the Riviera. Then there is a *commercial* transhumance, when beasts of foreign origin are sent to the mountains in summer for fattening, after which they are dispatched to the centres where they are to be slaughtered—Chamonix, Évian, Thonon, and Geneva. The Montagne d'Anterne, near Sixt, has long been used for this kind of business."

Arbos also contrasts commercial transhumance with the traditional transhumance of Provence, strongly emphasizing the superiority of the latter from the point of view of a prudent and lasting economy.

"The dwellings to be found in the Alpine pasturages are reduced to their simplest form in the sheep pastures. The *ramas* of Maurienne, the *houses* and *dormils* of the Briançonnais, and the *courtils* of Alpes-Maritimes are uncovered enclosures where the herdsman sleeps in the open air or in a kind of den. A great mountain area contains two kinds of buildings: the headquarters building and the *remues*. The former, occupied by the *chalézan* and his assistants, is called a *cave* in Tarentaise, a *chalet* in the Mont Blanc range, a *habert* in Chartreuse and at Belledonne, and a *cabane* in Alpes-Maritimes. It consists of a single room, near which are the *halles* where the flock shelters in bad weather. The *remues,* situated lower down the mountain, are temporary camps for the use of nomads. In the smaller mountains the habitations are more comfortable. They house both men and beasts, and generally contain several rooms. In Chablais the *chalets* are scarcely distinguishable from the permanent dwellings in the villages. In Maurienne and Oisans the men sleep on the hay in a single barn. At Sixt we find a mixed type: the men sleep on the hay, but there is a kitchen separated from the cattle-shed by a partition. The influence of environment is seen very clearly in the choice of building materials: wood predominates in the fore-Alps of Savoy, while stone is more in evidence in Dauphiné."[2]

There is another case in the French Alps, of which Paul Girardin and Raoul Blanchard have each made a very close study. It concerns a canton, or *escarton,* named Le Queyras, in Briançonnais, comprising the upper valleys of the Guil and its tributaries. "The existence of summer villages is hardly more than an accidental phenomenon due to depopulation and the downward movement of dwellings towards the large villages in the valley. The upper Guil valley is not a land of *chalets* in the sense of *mayens* or *stavoli,* and it is the same with the Molines valley. . . . In this district wide

[1] Ph. Arbos, *La Vie pastorale dans les alpes françaises, Étude de géographie humaine* (Paris, 1923), pp. 587–588.

[2] This fragmentary outline is borrowed from an article by Robert Perret on Arbos' book in *La Montagne* for February 15, 1924, pp. 33–46.

valleys make it possible for men to settle permanently at a great height, and there is no need for villages specially intended as summer residences. In areas too far away and definitely too high for winter dwellings simple barns have been built to house the supply of hay and to shelter the beasts in case of bad weather during their short stay in that neighbourhood."[1]

Arbos, in his turn, draws this conclusion from his investigations on the spot and his long study of the subject: "In many areas the decline of pastoral life is an undoubted fact, but it does not appear that the economic and demographic circumstances to which it is due are yet on the point of ending those migrations which have been a peculiar feature of the Alps at least since before the Middle Ages. And stock-raising remains, therefore, the principal element in human life in the French Alps."[2]

Pastoral migrations in the Alps in connexion with the rearing of cattle are *in general* short-distance ones, entailing the movement of only very small numbers of human beings, for to pass from their winter quarters to their summer pasturage the herds do not have to traverse whole areas engaged in quite different ways of exploiting the soil. It would be wrong, however, as in the case of sheep, to reduce cattle transhumance in the Alps to a single formula. There are some cases in which the pastoral care of cattle involves a series of regular migrations with fixed establishments, and therefore a true form of nomadism. The most representative example of this is to be found in the Val d'Anniviers, which for this reason has been chosen for detailed study in Chapter VII. In other cases the migrations are so short, and involve so few human individuals, that they cannot be regarded as real nomadism. Now, this cannot be explained—and this is a most important point—either by general ethnic conditions or by special ones of a political or historical kind. As a high Swiss valley in Valais, the Val d'Anniviers, has been selected as a type of what might be called nomadism raised to the highest power, let us take for comparison and contrast another high valley in Valais, not many miles from the first, where there is transhumance *without* nomadism—the valley of Conches. (See Fig. 109.)

The valley of Conches, in the canton of Valais, the upper part of the Rhône valley, has an essentially pastoral population, in which every one owns some beast, large or small, and generally both. Cattle and cheese are almost its only export, and for the people cheese takes the place occupied elsewhere by bread. The upper pastures are the sole resource of the area. They are of particular importance in districts agriculturally poor, where the people not only remain, but have been settled from the beginning. In contrast to this, where pasturage has been destroyed by excessive deforestation, as in the Gerenthal, there has been depopulation despite the favourable aspect of the fields and meadows. Most of the pastures are on the left bank of the Rhône, where the unfavourable aspect—on the shady side—excludes cultivation, which is all undertaken at the expense of the forest and the pasture. The villages, on the other hand, are generally grouped on the opposite bank, at the foot of the slope that faces the sun, in the midst of the cultivated fields.

The flocks and herds spend the winter in the village, moving in spring to the *mayens*, or between-season pasturages, and then going up stage by stage as far as the upper vegetation limit. In early autumn they again descend slowly, and end the summer season in the cattle-sheds.

However small in mileage this transhumance may be—and doubtless for that very reason—the inhabitants take little part in it. A few women and children accompany the beasts to the *mayens*, and three or four shepherds alone follow them to the higher pastures to make cheese. The rest of the people of Conches remain in the village. There is nothing like what happens in the Val d'Anniviers, where the entire population of the valley is in constant migration from valley to plain and from plain to mountain, so that each family is obliged to build a house at each of these stages. That is transhumance *and* nomadism; in Conches there is transhumance alone.

[1] Blanchard, "L'habitation en Queyras," in *La Géographie*, vol. xix (1909), p. 44.
[2] Arbos, *op. cit.*, p. 670.

Since about the fifteenth century the people of Conches have received some additional supplies by way of a mule-track connecting High Germany with the Po valley. In the seventeenth and eighteenth centuries more than two hundred horses and mules crossed the mountain every week. But the construction of the Simplon road in 1805 and the piercing of the St Gotthard tunnel in 1882 ruined this crosswise traffic and gave predominance to the lengthwise route following the *thalweg* of the Rhône. But traffic of quite a new kind has been opened up by the Conches carriage road, for it is frequented by tourists and divided into posting stages, one of which, called Fiesch, the starting-point for visitors to the Aletsch glacier and the Binn valley, has become the most populous and most thickly peopled village in the whole valley. Alongside its old wooden houses have been built hotels, shops, and banks.

Most of the other communes on the right bank of the Rhône have benefited by the same changes, though to a smaller extent. The advantages accruing to Blitzingen, Selkingen, and Ulrichen from a more gradual slope, longer periods of sunlight, and greater security against avalanches are not so great as those arising from the proximity of the carriage road. By contrast the decline of such places as Steinhaus, Ernen, and especially Ausserbinn, on the neglected left bank, has been striking.

But the influence of the highway is not confined to these changes in the relative importance of places in the Conches valley. That valley remained for a long time almost entirely closed to imports from outside, being nearly self-supporting. But this is no longer the case, for the cultivation of textiles, and even of cereals, is declining as the result of competition. On the other hand, however, the value of cheese and cattle is rising, and the valley is on the way to a condition of pastoral specialization.

While this transformation is being worked out the Conches peasant is already departing to a serious extent from his ancient ways. His economy is becoming a destructive one: not only are the upper pasturages no longer maintained, but the mountain is being robbed, for the benefit of the plain, of the natural manure provided by the grazing beasts. Above all, along with the cows there are now goats and sheep, the great enemies of the vegetation of the higher pastures, whose capacity is thereby reduced. This is borne witness to by such comparisons as historical documents allow us to make.

Such, then, is Conches, an interesting type of an Alpine pastoral district practising transhumance without nomadism, and of an economic oasis in process of absorption—a region passing from one geographical form to another.

*It is important thus to compare the peculiarities of nomadism and transhumance in near and distant geographical environments. Pierre Deffontaines has made some very interesting observations in connexion with pastoral migrations in Brazil.

After describing various types of nomadism—from plain to mountain, but also from mountain to plain or coast—and noting that in some cases the cattle are left to go up the mountain without guidance or supervision, Deffontaines asks himself the following questions. Does not the pastoral transhumance found in Brazil mark an embryonic stage in mountain pastoral economy? Was not the earliest pastoral exploitation of the uplands dictated by the cattle themselves? Did man create mountain transhumance, or was he not guided by the instinct of his domesticated animals, he himself merely improving the technique of nomadism? Is it not the case that the extremely complex systems of mountain economy—such as are seen, for instance, in the Alps—have passed through an earlier stage of "natural mountain life" like that which still exists in the sierras of Brazil?*

While setting forth for explanatory purposes a classification of the phenomena of human geography that shall serve particularly for training and guidance in direct observation, one has always to set these phenomena very carefully in their environment, and to connect those already classified with the whole of which they form a part. Thus we have been led quite naturally from the cultivated field and the herd to consider the human establishments of the cultivators and herdsmen, and have found our way back to the phenomena of the house and the highway in their relation to the conquest of the plant and animal worlds.

The preceding analytical studies have always eventually set complicated problems in economic and even social geography, leading straight to a critical examination of the various classes of human movements, such as migration, hawking and peddling, emigration, and so forth. This, then, is the time, before dealing with the last group of phenomena in this chapter on cultivation and stock-raising, to cast a glance back at the course we have followed, culminating always, as it should do, in human phenomena—men themselves. 1. Climates and cultivated plants. 2. General picture of types of cultivation and stock-raising. 3. Principal cereal foodstuffs. 4. Other kinds of plants. 5. Vegetable and animal textile products. 6. Other kinds of animals and nomadism. 7. Nomadism and transhumance. 8. Fairs and packmen.

8. Various Human Movements in their Original Relation to Areas of Transhumance

Fairs and Packmen

There is one form of human aggregation that is closely connected with the rearing of flocks and herds—namely, that regular but very intermittent aggregation known as the *fair*. The men who drive the flocks meet together at certain dates related to the migrations of the beasts, and for a few hours and in a very important way they occupy an area that remains deserted for the rest of the year. Moreover, in lands of intense and varied economic life, and with a growing population, fairs develop like nomadism itself, as we have noted in the Algerian steppe. They become more and more regular in their times, and they increase in number, the leading ones losing their supremacy and all becoming more regular. Thus they change by degrees into something resembling that kind of trading centre that characterizes the great urban aggregations—namely, the daily market (like the cattle market of La Villette, in Paris).

A. Allix, who has published many studies of fairs, quite rightly distinguishes four types, all called 'fairs,' either now or in the past, though they are subject to quite different geographical conditions. They are the merchandise fair, the urban market, the cattle fair, and the sample fair. He shows clearly that the site of a fair is never permanently fixed, and that relations are greatly restricted between the fair and the town that gives it hospitality—the 'host town.' A merchandise or cattle fair may even go on for a long time, like a country market, without any urban support, in the open country, even though it may give birth to a permanent aggregation. In all these facts can be seen the influence of the seasonal migrations made necessary by and for the life of the flocks and herds.

Where the fair works best is in countries where the whole life of individuals and groups is based on nomadism—or, to be more exact, on simple transhumance. When associated with this kind of life the fair in many cases acts as an urban centre, though in an intermittent and therefore extremely limited manner. That is why Allix calls the fair an intermittent and almost always periodical town, often situated close to a permanent one, but catering for special trading needs, and concentrating at a precise point of time the nomadic economic activity of a region of nomadism. He therefore sees in it, in its most general sense, "a regulating commercial organ of nomadism."

Although the system of travelling packmen is no more the exclusive speciality of mountain lands or transhumance zones than fairs are, yet the migratory habits and the alternations of climate which impel the dwellers in the uplands to look for a remunerative winter occupation are the two causes which in combination have given rise to seasonal migrations to a greater or less distance.

All the evidence goes to show that the earliest reasons for winter emigration in Oisans (department of Isère) were geographical conditions. Oral tradition dates this practice back to the beginning of the nineteenth century; in earlier days the people partly relieved their poverty in the cold season by begging. The packmen went off at the beginning of winter for varying periods. At the end of October those of the upper communes of Southern Oisans congregated at Bourg d'Oisans, including the small-ware dealers of Villard Reymond, the grocers and mercers of Villard-Notre-Dame (who spent seven months on the road), and the 'pedlars' of Saint-Christophe. From All Saints' Day to November 15 it was the turn of the flower-sellers, the herbalists, and the druggists. About Christmas and New Year's Day the jewellers and spectacle merchants set out, and at the beginning of spring the grain and seed merchants, many of whom had already made a winter journey with other wares, left Venosc and Villard-Notre-Dame. In April and May almost every one returned, to work in the fields and take the beasts to the uplands.

The packmen travelled by preference through the parts where the population was scattered, their winter nomadism making them "economic intermediaries between various organisms of a region of sedentaries." Each year they visited the same parts with fair regularity: "for forty years all the travelling food merchants from Oisans have carried on their trade in winter in South-western France." But sometimes, too, there are sudden changes of destination: thus those of the Oisans packmen who used to visit Burgundy and the northern part of the Central Massif at the end of the nineteenth century have entirely deserted those places in favour of the south. The right conclusion is drawn by A. Allix and C. Robert-Muller, the authors of *Un Type d'émigration alpine: les colporteurs de l'Oisans*, when they say that "the resources and the needs of the regions visited are more important in regard to the development of the packman system than the economic conditions of the places from which the packmen start."

What, then, has been the nature of the development of this system of travelling merchants in Oisans? The textile fabrics, seed grain, flowers, and foodstuffs which were formerly local products are now supplied to the packmen by areas outside Oisans. The system remains, though the region no longer provides the materials with which it works. It is perfectly true that, even though some kinds of trade were originally dictated, as it were, by the resources of Oisans, there are others, far more numerous, which have been determined by regional needs. To-day, and to an increasing extent, the packman of Oisans buys and sells in areas outside that district. The supplying centre is generally not far from the selling area. Thus the spectacle-dealers fill their big partitioned boxes at Morez and travel through Jura and Lorraine. In other cases the centre is merely a collecting-point within the selling area, to which the large firms send the goods required by the packmen.

There is one rather curious example of the packman system—the trade in flowers. Originally these travelling merchants took mountain flowers down to the lowlands, but it was not long before their increasing success led them to trade in all kinds of ornamental plants, though without abandoning the Alpine flowers. "The two centres, of supply and sale, have become very far removed from each other. The former is the actual production centre, such as the nurseries and gardens of Nantes, Angers, and the Paris suburbs, while the latter is indicated by the very nature of the goods—luxury commodities, destined for the large cities and wealthy districts." So the people of Oisans have not hesitated to leave their homes for longer or shorter periods. First they were emboldened to visit the rest of Europe, and then they set out for the New World and the Far East, settling down in the distant cities of North and South America, as well as at Saigon, Hong Kong, Peking, in Japan, and even in Australia, New Zealand, and South Africa. Yet the system remains for the most part a nomadic form of trade, intermittent, fairly regular, and recalling the rhythm of the mountain-dweller's original manner of life.

Now all the phenomena of the Oisans packman system, like those of transhumance and human pastoral movements, are undergoing a rapid and radical transformation: they are weakening and dying out. Railways, roads, and increased facilities for communication and penetration everywhere have all contributed largely to this decline. Towns, too, are to an increasing extent attracting all activities to themselves. Geographical differences have assisted only slightly to ensure or to endanger the continuance of the system. It is not always the most remote and poverty-stricken country hamlets

that to-day have most packmen: "family traditions or the chances of commercial success have been the most important factors" among the causes favouring the survival of the practice. It was most widespread around the year 1880, when there were from 800 to 900 packmen, which means that on an average one householder in every three in Oisans was a packman. In 1911 only 203 were left, or one householder in 18, and in 1921 the number was 85, or one in 37—a very rapid decrease. The district has become at the same time less populous and richer; hence "the reason for the packman system has become less a geographical necessity than a traditional commercial habit."

Our authors conclude their study by explaining why they call the Oisans system a geographical phenomenon. It is conditions of physical geography that originally determined these movements. Men were driven to winter migration, and their initiative had to seek for solutions within this rigid framework. In the choice of the wares to be sold Oisans, it is true, plays an insignificant part to-day, of far greater importance being the nature of the goods desired by the inhabitants of the districts in which they are sold. And, finally, it must be particularly borne in mind that the lands where this system has been most frequently observed are regions of scattered dwellings where it was practised of old by the inhabitants themselves or their near neighbours: "the greater abundance of merchants in Oisans seems to be only a matter of human imitation." Social influences and traditional collective habits, therefore, are other geographical factors determining this human phenomenon.

All the phenomena of nomadism, whether obsolete or still continuing, are more or less directly connected with fairs and the system of travelling packmen.

In an article in the *Revue de l'histoire des religions* (1922) François Berge has studied the curious gathering at Saintes-Maries-de-la-Mer, in Camargue, of the Gipsies (a corruption of *Egyptian*)—also called Romany, Gitanos, and Tziganes—on the occasion of the principal feast of the Saint Marys on May 24 and 25. This traditional social event, which I have myself seen, appears from all the evidence to be in a state of decline, but none the less it still attracts every year several hundreds of these nomadic kinsmen of the Tziganes of Central and South-eastern Europe. Those Gipsies, still numerous, who have remained nomads travel the roads in their travelling dwellings. Most of them, dealers or horse-shearers, have need of sedentaries, especially those who live by large-scale cultivation or horse-rearing. They regulate their movements according to the dates of the fairs, and they develop in areas of dense population. When they become sedentary they remain horse-dealers, and continue to frequent the fairs, though they do so by rail or car!

And so, proceeding from the essential material facts that we observe, we always and unfailingly arrive at ways of life and agricultural economies, or, better still, at regional economies.

Closely connected, at all events in their origin, with the general conditions of cultivation and stock-raising—that is, with the living conditions of cultivators and herdsmen—are all the complex phenomena of emigration and invasion. Then many other factors mingle with these, particularly the need for industrial labour. Moreover, the highly important historical phenomena based on slow emigration and sudden migrations have been increased or restricted, favoured or banned, by human groups, whether cities, tribes, or modern political communities. To-day more than ever it is essential to ascertain the point at which emigration and immigration tend to be determined and regulated by states according to their interests and their feelings. That is pre-eminently and in all cases one of the most important branches of state policy, and of the geography of history.

Chapter V

ESSENTIAL FACTS OF HUMAN GEOGRAPHY

THIRD GROUP: DESTRUCTIVE OCCUPATION OF THE SOIL, DESTRUCTION OF PLANTS AND ANIMALS, EXPLOITATION OF MINERALS

1. Peculiarities of Destructive Occupation

UNDER the general term 'destructive occupation' should be classed all kinds of exploitation of the earth whose object is to take raw materials from it—mineral, vegetable, or animal—without restitution of any kind. Those who take marble or sandstone from a quarry to build their houses are removing materials embedded by Nature in the soil with no idea of putting them back. Hunting and fishing, apart from those connected with the rearing of pheasants or salmon, etc., are equally robberies from Nature not compensated by any deliberate course of human action.

Among the various forms of destructive occupation some are of a normal and systematic character, while others, on the contrary, are carried out with an unrestrained intensity that makes them well deserve the German name *Raubwirtschaft*—'robber economy,' or, more simply, devastation.

Destructive, or robber, economy is in a way a special form of wild-fruit picking, but it makes a far more violent attack upon Nature. This violence may result in poverty, and then we have actual devastation or laying waste.

DESTRUCTIVE OCCUPATION BY CIVILIZED PEOPLES

It seems strange that this devastation should be the particular accompaniment of civilization, while so-called savages know it only in its less extreme forms. They do indeed indulge in partial destruction and spoliation, but hardly ever resort to devastation in the strict sense of the word. They practise devastation when they burn down the forests and cultivate the soil thus acquired until it is exhausted. But in the regions where they live there is plenty of land, and this procedure does not lead to any shortage of the means of subsistence: it means merely a nomadic life. Burning the forest, especially in a moist climate, is, in fact, the only means by which primitive human beings can settle down and live more or less by cultivating the soil. Neither is hunting, strictly speaking, a matter of destructive occupation among savage peoples, for it is not so intensive as not to be made up for by the regenerative forces of Nature. It is true, therefore, that actual devastation, with all its consequences, becomes particularly intense among civilized peoples.

PRINCIPAL FACTS CONCERNING DESTRUCTIVE OCCUPATION

(*A*) MINERAL KINGDOM. The exploitation of mines is always a form of destructive occupation, in the sense that it is impossible to replace the materials taken from the earth. This is the case even in its most legitimate form. (See Figs. 96 and 97.) But the term 'destructive exploitation' should be taken to mean only improper exploitation, and such as extends too widely over the surface through desire for immediate gain, like

the wretched surface exploitation of silver ore in the south of Spain. The consequences of this devastating kind of exploitation are not very visible except where the material removed is found only in limited areas and in relatively small quantities: the supply of guano, for instance, has been exhausted in a few decades. At the present time coal is being improperly exploited, and despite the enormous quantities of this precious fuel in the bowels of the earth, the time will come when highly important deposits will be exhausted.

(*B*) Vegetable Kingdom. Perhaps even better known than mining devastation is robber economy in cultivation, which makes war on the fertility of the soil by greedily removing its nutritive elements without replacing them, man's sole desire being to produce at minimum cost and without restitution. In Western Europe, with its very dense population and very intensive cultivation, this kind of devastation is to-day rarely met with, for necessity has shown men the part to be played by fertilizers. But in colonial lands it is different. There the agriculturist, even if a European, has been put back, as it were, into the position of a savage, and sets out to exploit the land as he does. He cultivates different pieces of land in succession—at all events, so long as the population is not very dense—and exhausts the surface of one piece after another. Many are the wheat-growers who have practised this robber economy, particularly in the temperate zones—in the United States, Canada, Russia, Siberia, and the Argentine, all lands of a superior civilization, too. In the United States (Dakota, Nebraska, Minnesota, etc.) the consequences of this devastation have made themselves felt, and a change for the better in the method of exploitation has become imperatively necessary.

The Chinese have undoubtedly arrived at their very painstaking system of cultivation by way of devastation, and the absence of trees on so many bare and bleak areas remains as evidence of a traditional process of deforestation. Civilized man, indeed, practises the art of destruction in an exceptional way in the forests, for these are themselves a true source of wealth when man learns the right way to maintain and make use of them. Though savages lay waste the land by making clearings in the forests, yet these clearings are small, they are soon abandoned, and they quickly disappear, as the example of the Fang will show. Such devastation is confined to the shores of the seas and rivers, but with the progress of colonization and the improvement of means of communication it attacks regions formerly inaccessible. (See Figs. 99–101.)

But it is islands, above all, in every kind of climate, that have been thus laid waste. Ceylon, Mauritius, Réunion, the Seychelles, Madeira, St Helena, some of the Bahamas, and most of the islands of the Mediterranean have all been partially or even totally deforested.

The principal areas of forest devastation is the north temperate zone, peopled by civilized white races, and wherever these races settle the forest retires before the 'pioneer front'—in Canada, in Brazil (see Fig. 104), and elsewhere. Thus the destruction of forests is essentially the work of civilization, of a more dense population, and of more perfect tools (Ratzel).

When wood is replaced by new products or agents it would seem to be no longer the indispensable auxiliary that it has been for centuries. But let us make no mistake: wood is more than ever indispensable to the modern industrial world, for such things as pit-props, railway sleepers, wood paving, and above all as pulp for making paper, etc. *It is the basic material of many substitute products. (See what was said about rayon (p. 128 above), and for other products see p. 167 below.)*

Thanks to all the means of transport in use to-day, from the most ancient, such as river floatage

(see Fig. 102), to the most modern, it can be said that timber is brought from all quarters to the great markets (see Figs. 14 and 103), and for this reason the nineteenth and twentieth centuries have been terrible squanderers of the wealth of the forests. Fortunately, some lands—such as Finland, Sweden, and Canada—still have valuable reserves of timber, but we must not lose sight of the alarming and ever-increasing consumption, still further increased by the War, of the great industrial countries of the world. From all quarters come reports of catastrophes in regions now stripped bare of trees—of floods on Alpine or Pyrenean slopes, of the hollowing-out of the Russian plains, and so forth. So loud have been the lamentations that in Western Europe, and particularly in France, re-afforestation is not only a matter of immediate concern, but a process that has already been started. Steps should be taken, without neglecting re-afforestation, to put an immediate end to selfish and savage deforestation in places where woods and forests yet remain.

In colonies where Europeans have no thought of settling permanently they establish trading stations around which there gradually grows up a system of plant exploitation. The native is required to supply the raw material, and this he can do with little difficulty when the colonizing process begins; he practises the wild-fruit picking economy. But it is not long before he reaches the devastation stage, under the stimulus of the prices he receives, and eventually a system of cultivation and regular production is created. Before that, however, much produce of incalculable value, which might have been preserved for more permanent use, has been destroyed.

(*C*) Animal Kingdom. The ravages of devastation extend also to animals. If man kills them for food or clothing and takes care to see that they reproduce themselves, that is called stock-raising (see Chapter IV). Neither is it really robber economy when men are compelled by the growth of population to put limits to the domain of the beasts. And man has a right also to destroy animals that do harm. But it is indeed another matter when hunting is pursued as a sport, for it turns speedily into devastation if harmless animals are hunted without restriction. Hunting was the earliest condition of colonization, but, like the clearing of land, it too often becomes devastation.

In France 75 million acres out of the 112 million that form the "hunting domain" remain given up to "common hunting, which should be looked upon as a real plague." This it is that has made a desert of the southern provinces where in the seventeenth and eighteenth centuries "people were tired of eating quails and partridges every day and at every meal in the hostelries."[1]

Animal destruction is particularly devastating on the northern and southern edges of the northern forest region. In Canada, the northern United States, and Northern Russia and Siberia fur-bearing animals are hunted on a large scale, while in the southern part of this area devastation is well-nigh complete. The beaver, sought after at first for its flesh and later for its fur, has almost entirely disappeared, and in America millions of buffaloes were slaughtered in ten years.

The extinction of an animal species is most rapidly achieved in limited areas, and especially in small islands. Thus England was in advance of the Continent in exterminating the bear, the lynx, the wolf, the red deer, the elk, and the beaver, and in the island of Réunion the great dodo (*Didus ineptus*) was extirpated in less than ten years.

The devastation of the animal kingdom is most fatally obvious in the sea, where it is encouraged by international competition in the slaughter of seals, turtles, and whales. It is in Arctic waters, where the great sea mammals are particularly numerous, that destruction is most rife, bringing in its train not only the impoverishment of the marine fauna, but also the retreat of those northern peoples who live on the flesh and fat of these creatures.

Fishing has a tendency everywhere to become exterminatory. (See Fig. 98.) Even

[1] G. Hanotaux, quoted by Maurice Lair in an article in the *Revue économique internationale*, September 15–20, 1909, pp. 399–424.

in the case of rivers and lakes, where re-stocking is ensured, fishing is a menace. Lake Neufchatel, for instance, is so intensively exploited, with the aid of nets and unprohibited implements alone, that it is suffering marked impoverishment, and the cantonal Government has been forced to adopt new measures to protect the fish.

Finally, there is one kind of devastation which attacks man himself, doing injury to his very life or removing him completely from his environment. Such things as natural safe refuges, places that lend themselves well to attack or to flight, and contrasts between poverty and comfort have in all ages brought devastation, whether in a violent or a milder form.

Thus oases attract nomads who are conscious of their strength and feel themselves superior to the peaceful possessors of these favoured spots, and one necessary consequence of this fact is the retreat of agriculture and the encroachment of the desert on areas formerly irrigated and cultivated. Seas full of islands, especially inland seas, as well as mountains and inaccessible forests, have always in the same way encouraged devastation in the shape of piracy or brigandage. War too is a form of robber economy that should find a place here: it is a violent and terrible struggle for space and life.

One of the most dreadful kinds of devastation among human beings is the trade in Negroes, started by European colonizers when they transported the unhappy blacks from one continent to another. Colonization has too often meant an attack on 'savages,' either by destroying their food resources or by importing actual poisons like brandy. It is a universally acknowledged fact that uncivilized peoples perish when brought into contact with our civilization.

Directly connected with this subject is a study we presented in 1905 to the Mons congress on world economic expansion, and published later in the Paris *Revue d'économie politique* (1906) under the title "The Colonization of New Countries and the Protection of Native Women." If there is truth in Ruskin's fine saying that there is no wealth but life, then the greatest social crime that can be committed by those who colonize new lands is to attack or to dry up the very sources of life. Protection for native races means protection for their women first. To misuse native women or to allow them to suffer abduction, officially recognized or disguised—a special form of robber economy—is beyond any doubt a graver crime than to destroy birds of rare plumage or to plunder the oil or wine palm.

The extermination of native races has made most rapid progress in regions whose climate is favourable to European settlers—North America, the Argentine, South Africa, and Australia. Strictly speaking, it might be advanced as an explanation of this—though not as an excuse—that the Europeans were compelled by the growth of their own population to extend their frontiers, but how is one to justify the slow extermination of 'savages' in regions where no European can live?

The last form of human devastation is cannibalism, which is nowadays confined almost entirely to tropical and equatorial regions.

To-day's Reaction against Destructive Economy

A great deal of attention has been given in recent times to all these destructive excesses, and vigorous measures against devastation have been adopted in Europe, the United States, and Canada. The United States set the example by establishing those natural museums, as it were, called National Parks—true 'conservatories' of animal and plant life, as well as of all other kinds of natural wealth. Similar parks have been created in Canada, the Argentine, Germany, Switzerland, France, and elsewhere. Special laws have also been passed to protect fish and game and even landscapes. As the effects of

devastation become increasingly apparent there is noticeable, at all events in Europe, a certain solicitude for everything that is in danger of total disappearance, and that is the policy pursued in France's overseas territories. This concern is shown particularly in the case of forests. The close connexion that exists between forests and water, the need for protection against the violence of the latter, and the desire to use it as an industrial force have given our contemporaries a better understanding of the urgent need to safeguard these two forms of wealth which are in danger of being lost to us. Trees and water are interdependent, and such apostles of re-afforestation as Fabre and Henry have made public opinion realize that it must wake up and make provision for the indispensable safety of the trees.

Italy, which with no coal and scarcely any iron has yet managed to establish large-scale industry despite these exceptionally unfavourable conditions, has worked energetically to hasten the substitution of white coal for black. "Italy's main economic policy can only be a policy of wood and water," said Nitti.[1] And in the arid regions of the United States, according to President Roosevelt's first message to Congress on December 3, 1901, it is water, and not land, that gives the measure of production. In a single sentence the President summed up the whole matter, not only for the United States, but for the countries of the Old World as well, when he said, "The forest and water problems are perhaps the most vital internal problems of the United States."

In this manner there is being created in all civilized lands a philosophy of deliberate reaction against the excesses of the destructive occupation of the soil, and the scientific work which has best summarized all these recent tendencies is Bernard Brunhes' *La Dégradation de l'énergie* [*The Dissipation of Energy*].

"It has been said by Ostwald," writes Bernard Brunhes, "that civilization is the art of using the crude energy of nature. But advances in civilization are not all equally good. If man's action is always restricted by the impossibility of making the world go backward he yet has the power to retard or to hasten the dissipation of energy. However beneficent industry may be when it slows down this dissipation, it is maleficent when it speeds it up and practises *Raubwirtschaft*—the robber economy that lays nature waste. 'The free play of natural laws' involves a universal tendency to dissipate force and energy, and the extent to which a given epoch fights against this tendency may be regarded as the very measure of its degree of civilization. In this respect the worst barbarians are certain civilized peoples, and it is very true to say that 'nature,' though not 'good,' since it is unceasingly wearing out, and though capable of being improved by genuine civilization, becomes worse if it is in the hands of civilized peoples who are barbarians. The old problem, discussed by Rousseau, of the inferiority or superiority of 'society' to the 'state of nature' might in one sense be put in this form: Does society bring about an acceleration or a retardation of the dissipation of the energy in nature?"[2]

And, again: "The amount of energy used is, and will be for a long time yet, only an imperceptible fraction of the energy that is usable. Nor is it hard to conceive that the amount of energy used may increase while the amount that is usable diminishes. However rapid 'progress' may be, it will never be possible for used energy to exceed what is usable. And, to confine ourselves to the usable energy that our solar system contains, and not lay ourselves open to the charge of arguing about the entire universe, we are able to use only an infinitesimal portion of it. It is this minute used portion that has to increase the development of life on the earth's surface, and to increase in particular the development of civilization when that development does not take place in the wrong direction."[3]

With this reaction against a destructive economy should be linked also the anxiety that is felt to-day, owing particularly to the difficulty of obtaining raw materials, to salvage products already used, so as to obtain new ones—rubber, leather, and so forth.

[1] *Revue économique internationale*, April 15–20, 1909, p. 54.
[2] Pp. 196–197.
[3] P. 195.

After this general outline to show the widespread incidence and the many varieties of actual and potential destruction of the earth's resources it will be as well to take note more precisely of the strictly geographical relations between these various forms of destructive economy on the one hand and human activities on the other.

One of the commonest phenomena is the connexion between nomadism and devastation, both vegetable and animal. When we examined some forms of pastoral nomadism in the last chapter we were careful to note, first, that nomadism is not necessarily connected with pastoral farming, or even with transhumance, and, secondly, that nomadism is not the only feature of the pastoral way of life. What does remain true is that whenever there is periodic devastation there is nomadism. Thus there is nomadism of a more or less regular kind in fishing, in hunting, in wild-fruit picking, and in the destruction of forests. There may even be more or less regular nomadism in cultivation, when this is of so primitive a character as to fall into the category of destructive economy. To make this more understandable we shall offer now a detailed 'human sample,' chosen as a typical instance.

2. Exploitation by Primitive Peoples

Complex Type of Plant and Animal Destruction in the Equatorial Forest—the Fang

The equatorial forest of the Congo is the scene to-day of the migrations of the Fang, or Pahouins. Buried in the natural or artificial clearings of the forest, they move on to invade the abodes of other tribes, with the tacit consent of the latter, often abandoning themselves to acts of violence that cause them to be feared by their weaker or more timid neighbours. We are dealing here not with the Fang throughout the whole of the vast area over which they are scattered, but in a particular region on the middle course of the Ogowe river, forming a rough circle of some sixty miles' radius, whose centre is Njole and which extends along the river from Mount Otombi to Samkita and from the upper Abanga, in the north, to the sources of the Lebe, in the south. Apart from a few Akele villages at Samkita and on the Mbomi and the Lebe, all the human settlements are those of the Fang tribe, speaking the same tongue and having the same racial origin. This district is fully representative of the various Fang peoples, for it is the meeting-place of several natural regions of the equatorial forest. It is easy to get an idea of the climate of this area from the fact that the latitude of Njole is 0° 8′ S. (See Map XXVIII.)

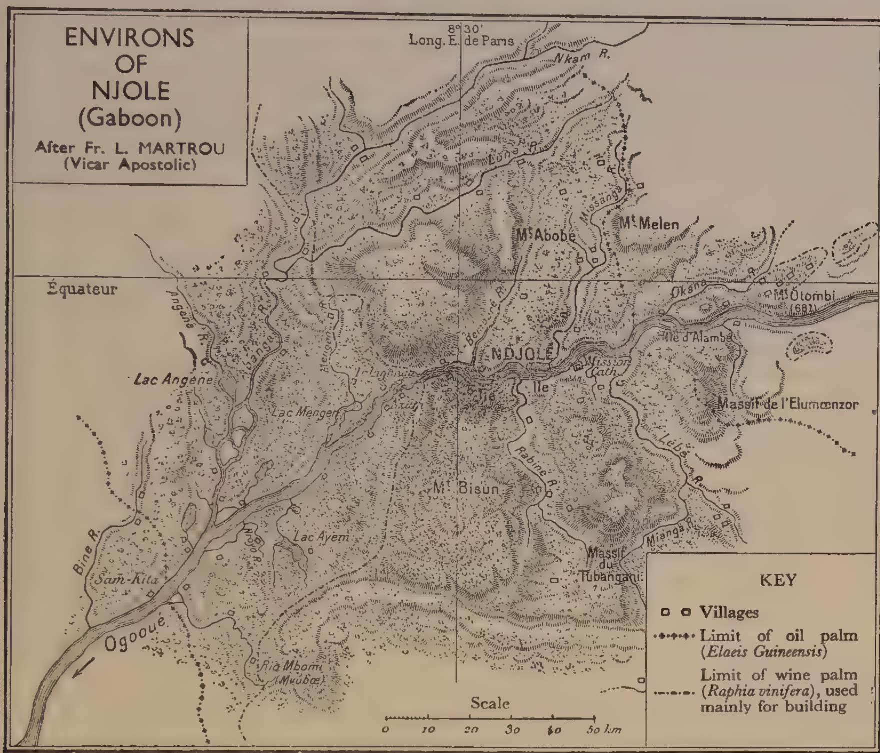
The Fang Village

The Fang village is always built not far from a stream, for wells, cisterns, and aqueducts are unknown. In this equatorial climate with its abundant rainfall there is no lack of rivers, so it is easy for the Fang to settle near water. The village consists of one street flanked by two parallel rows of rectangular huts, all joined together. The two ends of the courtyard thus formed are closed by two guardrooms (which serve as meeting-places for the men and reception halls for strangers), solidly built of rounds of asœis (*Musango*), a soft wood not easily pierced by native bullets. In this guardroom there are always a few guns in case of hostilities with neighbouring villages, and through the narrow doorway and the loopholes a watch can be kept on the road and the river. Behind the huts stretches the banana plantation, where each woman has a few feet of ground growing bananas, pimento, sweet potatoes, and so forth. When a guest arrives unexpectedly or when the weather is too bad to go to distant plantations she uses the fruit of this one.

How, then, do the Fang live? By the destruction of the forest—fruit-picking and cultivation—and by fishing and hunting. We will now follow them in the movements entailed by all these forms of destructive occupation of the soil.

Fruit-picking, Forest Exploitation, and Cultivation

Almost all the forest fruits ripen during the sunshine of the early dry season, February and March, and a certain number of them are edible and used by the natives. Sometimes the work of picking necessitates camping out for the whole time it lasts. Fr. Martrou came across an encampment of this kind a dozen miles from Njole, containing two or three men and many women and children. They



Map XXVIII

Njole District, on the Ogowe

From information supplied by Fr. Martrou, 1909

had cut down near by four or five trees of the terebinth family, called *ascia*, whose fruit when stewed is highly esteemed by the natives, and even by Europeans. But it is chiefly to gather *ndoi* (*Trvingia Gabonensis, Oba Gabonensis*) that the Fang betake themselves to the parts of the forest where these trees abound. In the Samkita district and on the lower Abanga they give a whole month to this business. A camp is made in these favoured spots, and the man goes there with his wives just when the over-ripe fruit falls from the tree. When all the fruit has fallen, or when the baskets are full, the family returns to the village to make the precious loaf. This is the women's task, the men merely constructing the temporary camp and protecting and ruling this short-lived settlement far removed from the village.

When European trade came to the Congo it made a great difference to the work of the natives, who had made no industrial use of their ebony, mahogany, rosewood, copal, or rubber, and the few

things they made of ivory, such as trumpets, pipes, spoons, etc., gave very little value to elephants' tusks. But when the white trader bought these products, giving in exchange things the natives wanted, there was the beginning of a new phase of destructive activity. The Fang have sold much ebony to the trading stations on the lower Ogowe, especially during the last ten years. At first they cut down the trees on the banks of the river, the streamlets, and the navigable waterways, but to-day the ebony is found farther away, and the trees must be felled at a great distance. So when work in the village is not pressing and the villagers want some European goods they decide to go and camp in the forest, six or seven miles away, and 'make ebony.' Then a few men settle there for a few days, with their wives, in a corner of the forest where ebony-trees are plentiful.

The Fang are not content, however, with these direct forms of plant depredation, for they cultivate as well. But their cultivation presupposes and entails renewed destruction. When the *aboiæ nzoï*, a tall tree with twisted branches, has shed its leaves, and the *suræ* fruit has fallen it is time to begin garden-work. The peak period of plant life falls in the 'little dry season' (March), and the Fang, being well aware of this, set forth at the end of January. They look for a suitable spot in the forest, settle among themselves the boundaries of each plantation, and work begins. When the undergrowth has been cleared the men cut down the great trees, leaving here and there only a few giants too hard for them to tackle, or a few whose fruit is edible. All the rest are ruthlessly cut down, never at ground-level, but about six feet above it. This is a long and laborious business. Then at the beginning of March the bushes, reeds, and branches of the trees are chopped in pieces and burnt, so that there soon remains nothing of the forest but the great tree-trunks lying on the ground. Here, in soil covered with ashes and humus, the women plant banana-trees, manioc-stems, and pumpkin-seeds. By this time it is towards the end of March and rainfall is becoming abundant, so bananas, manioc, fruits, and vegetables ripen quickly. The Fang are therefore dependent on water for their crops: they wait for the rain, and regulate their work in accordance with it, and if their calendar is unfortunately wrong there is a partial famine. The banana-tree is a particularly delicate one, and a prolonged dry season after a short rainy one will prevent its bearing fruit. If, on the other hand, the fall of the *suræ* takes the Fang by surprise before he has burnt the rubbish, then his plantation is spoilt by being not properly burnt, encumbered with branches, and without ashes to manure it.

There is no such thing as general famine among the Fang, as there is in India and the other monsoon lands. This is due to the nature of the crops: manioc and yams are fairly hardy, and even banana-trees bear fruit all the year round. There is no harvest, so no granaries are needed. A garden lasts for two years, and food is taken from it just when required until it is completely exhausted, by which time the new garden should be coming into production.

Whenever the gardens to be made are far from the main village—say, a day's march or more—a *mfini*, or plantation village, is built. This is exactly like the ordinary village, and follows the same plan, but is not so well built: the street is narrower, and the huts are smaller and have no gallery. It is a temporary centre of settlement during the period of garden-work. Moreover, when the main village is threatened it is abandoned, and the *mfini* becomes the actual social centre. If the village is an important one, with four or five guardrooms, it has several *mfini*. Each village has its own *mfini*, in the midst of the plantations.

Those who dwell in villages in the savanna country have no *mfini*. They make their gardens in the adjacent forest, and when this is exhausted they move farther on. So, too, the villages situated far from navigable waterways make their plantations near by, within an hour's radius, and when the circle of forest is all turned into a wilderness of brushwood they decide to begin their migrations again.

When work on the plantations is finished the men and women return to their village. But agricultural workers are to be found in the *mfini* at other times of the year also. In June, for instance, the weeds that have grown with the rainfall are threatening to stifle the young plants, so the women go weeding, cutting them down with a *machete*. In August, again, the middle of the dry season, the Fang engage in more wood-cutting, though on a smaller scale, so as to be ready for the first October rains and to sow maize, ground nuts, cucumbers, tomatoes, pimento, and so forth. **Everywhere and always destruction is the prelude and fire the necessary condition of cultivation.**

Fishing and Hunting

By about August 15 the waters have fallen considerably. This happy event has been long awaited by the Fang, especially in the region of lakes and ponds. They have watched attentively the fall in the water-level as shown by some tree-trunk used as in indicator, until at length some particular rock in their landing-stage appears above the water, and the time for fishing has come. Then they go and set up a regular camp on the shore of the lake, stream, or river-channel, leaving very few people in the village, for all are longing to gorge themselves on fish. All 'palaver' comes to an end, as by a tacit truce. The casting-net (a European importation), the ordinary nets of ananas fibre, the building of dams and draining of pools, the use of poisonous plants to kill the fish—all these methods are put under contribution. Enormous quantities of fish are eaten during the first few days, and attention is then turned to curing it. The camp is a large one, with high roofs, and the drying-rack of raphia-palm stems is a well-made appliance. The camp sometimes has several parallel streets, and to it are taken even the village dogs and fowls.

After seeking thus in the waters for fish the Fang go to hunt in the forest for the supplementary food that is so essential to them. But the game they are in search of lives far from human settlements, for it is disturbed by noise and the comings and goings of men, and is most often found in certain uninhabited districts. Of this the Fang are well aware, and at certain favourable seasons they move to these districts for their hunting. Again they set up a camp, though a much less elaborate one than is used for fishing. It is just a matter of stakes driven into the ground, a framework to support a roof of leaves, a drying-rack and fireplace, and some rounds of wood for beds. Thither go some ten or twelve men and two or three women. Sometimes the men hunt all through the day. They cut off an entire corner of the forest with a palisade, and at fixed intervals the line of the palisade is broken and a deep trench dug, covered carefully with twigs and leaves. The wild hogs, antelopes, etc., seeking an outlet, fall into these trenches, where they are found next day. This device of palisade and trench is most effective during the great floods, so it has to be constructed some time before. It creates peninsulas, as it were, where many wild creatures take refuge, and isthmuses where they can pass. After ten or fifteen days, or three weeks at the most, the hunting season comes to an end, and the hunters return to the village with the dried meat, which gives variety for some time to come to the dietary of those who have been fortunate in the chase.

Migrations resulting from these Forms of Destructive Occupation

These various moves do not prevent the Fang from returning to their village, and this they are glad to do, for it contains their huts, their homes, and their burial-ground. To see one of these villages, with its apparently happy and care-free inhabitants, you would think it would stay there for ever. But after some four or five years it needs repair: the roofs are in holes and the courtyard worn away. If it is decided to remain in the same place the village is rebuilt, but at a distance of some twenty, thirty, or a hundred yards, to obviate some inconvenient feature that has become apparent to the villagers during their stay there, such as a too steeply sloping courtyard, too great distance from the river, a wrong aspect, lack of shelter from tornadoes, and so forth. The restored village keeps its old name.

But one day there is a new clearing on the bank of a stream where hitherto there had been nothing but forest, and a few poor temporary huts have appeared, with a few men to form an advance-guard. Then as the old village falls into decay, so does the number of these provisional huts increase, till one day the whole tribe sets forth, taking with them the children, cases packed with clothes, cooking pots and pans, and the household gods or fetishes, and proceeds to the new settlement. This is sometimes fifteen or twenty miles away in a straight line, and it takes several days for this nomad horde, encumbered with children and baggage, to reach its new abode. The old village becomes overgrown with reeds and tall weeds, and soon the tropical forest around it closes in and heals the wound that human labour had made.

The length of these stages varies. Economic and social reasons may cause a village to remain for some years, keeping it longer than usual on its nomadic course. But the average duration is five or

six years. An old man at Njole, relating the story of his tribe, located his birthplace at a village on the Lom, a small tributary of the upper Windo, and since then his family had moved its village thirteen times: the man's age was sixty-five or seventy.

These periodic migrations cannot be completely explained by reasons of geographical environment alone. For instance, a village may be moved owing to a war with other villages, or the departure of a family may be caused by the hostility of a powerful tribe, the imposition of a tax, the death of some important man, or some superstitious reason like the cry of an owl in the neighbourhood. But the most general causes of migrations are of a geographical nature, and result from the destructive occupation of the soil. A considerable extent of land is required to feed a Fang village, and as their methods of cultivation are primitive, and no manure is used, the garden is abandoned after the second or third crop has been gathered. Hundreds of acres fall every year under the axes of the Fang, before long the plantations are too far from the village, and "the forest is finished." So the village moves farther away to find where it is still intact.

Sometimes the village leaves a district because its banana and manioc plantations are ravaged by animals, especially the wild boar and the elephant.

Across the vast forest there are real 'lines of nomadism,' as it were. Sometimes on this regular line there are sharp twists and turns, where a trade centre has attracted the family clan, which has returned to the beaten track when the attraction has ceased, proceeding to the west or south-west along the original line of the migrants' road. These 'lines of nomadism' are a veritable trail of death in the equatorial forest, for obviously the passage of serried ranks of travelling Fang is bound to diminish the natural wealth of the soil. So the strictly geographical consequences of this complex and multiform nomadism are that the forest is hewn down for the benefit of primitive cultivation and replaced by brushwood thickets, the banana zone continually shrinks and becomes ever scarcer, the climbing rubber-plants are cut down, and fruit-bearing trees are thrown to the ground to facilitate picking. The Fang too, having no thought of settling permanently, plant no fruit trees, even where they would grow well, such as bread-fruit, mango, avocado, orange, cocoa, and coffee, because when these would be in full bearing the planters would be far away, neither they nor their children would reap any benefit from the labour expended, and they have no desire to toil for others' gain.

We leave now this typical group of primitive folk who live in very truth on *Raubwirtschaft*, to see the effects of the most highly developed forms of destructive occupation among peoples in the most advanced stages of civilization.

3. Exploitation by Civilized Peoples

Sudden Discoveries, Displacements, Exhaustion, and Renewals in Extractive Industries—Constructive Significance of Destructive Economy

Mineral devastation does not involve nomadism, either visible or immediate, but in its rudimentary and what might be called its plundering form it does entail removals owing to chance circumstances, causing it to resemble a hunting expedition. Thus the earliest search for gold in California and Alaska was a kind of freak migration of 'hunters' in quest of the precious metal.

The industrial structure associated with an extractive industry may also be subject to displacement. The glass industry of the United States lived first on the destruction of the woods, then on that of coal (Pittsburgh), and finally on that of natural gas, whose sources are always short-lived. It should be observed that this 'nomadism' of the American glass-making industry (like the exploitation of gold, etc.) is not true nomadism, for it involves no return journey and no periodicity.

The essential characteristic of mineral exploitation is that it fixes man's labour, suddenly and for the time being only, at one particular spot on the earth, and hence arises the exceptional geographical value of all the peculiarities of mineral exploitation.

The strictly geographical study of quarries and mines may take the form of local monographs, such as the work of Ardaillon on the silver-mines of Laurium, and geographical studies of the Sicilian sulphur-mines, the copper-mines of Rio Tinto, the tin of the Malay Peninsula, and so forth. It is desirable to pay particular attention to the general distribution of a mineral. In the words of A. de Lapparent:

"According to Suess, rock-salt and gypsum are indications of lands characterized by the absence of drainage or by a central position, while coal, a product of deltas, is formed on the edges of areas provided with regular drainage. Thus the adjectives 'central' and 'peripheral,' employed by Richthofen in connexion with Asia, have as correlatives the terms 'salt' and 'coal.'"

Oil

In all cases, general and local alike, the geographer is concerned with physiognomic facts of surface and depth—what might be called the external and internal landscape. At those points where man starts to exploit a product furnished by the earth he establishes himself in a way that alters their natural appearance. Thus in oil-exploiting centres the scene of man's activity is marked by such characteristics as the forest of tall quadrangular pyramids over the bore-holes or the great storage-tanks for naphtha. In this way oil has created a new kind of landscape. The Standard Oil Company, at first only a transport business, started the system of *pipe-lines*, hundreds of miles long, its example being followed in the Old World by the pipe-lines from Baku, on the Caspian, to Batum, on the Black Sea, from Iraq to the Mediterranean, from Le Havre to Saint Jérome, and so forth. And maritime refuelling stations for fuel oil are being set up everywhere in a similar way. The English have built a gigantic oil-fuel depot at Singapore. The sea too has become covered with tankers.

From the economic point of view it is important to emphasize the *speed* of some of these phenomena. Oil has been exploited at Baku only since 1865, and in Pennsylvania only since 1859. World production of oil, which was less than four million tons in 1880 and ten million in 1900, exceeded 270 million tons in 1938, and reached 285 million in 1939, 320 million in 1943, and 370 million in 1945.

The sixteen countries which between them produced more than 98 per cent. of the total production of oil in 1938 were as follows (quantities in millions of tons):

United States	164·0	Colombia	2·8
Venezuela	27·4	Trinidad	2·4
U.S.S.R.	24·4	Argentine	2·1
Persia	10·6	Peru	2·1
Netherlands Indies	7·3	Bahrein	1·1
Rumania	6·7	Burma	1·0
Mexico	4·2	Canada	0·9
Iraq	4·1	Borneo	0·8

European production, which in 1913 was nearly a quarter of the total, was even in 1920 less than one-fifteenth. In 1901 Russia held the first place in the world among producing countries, but in 1913 she was already far outstripped by the United States. After the tremendous fall in production that followed the 1917 Revolution Russia (including Sakhalin) regained the third place, and whereas in Rumania the oilfields have become exhausted, causing a fall in production, the discovery of new oilfields in Canada has brought about an increase in production in that country of 157 per cent. on that of 1937, and if the commercial outlets had not then failed the increase would have been still greater. It should be remembered, too, that as the result of agreements made after the War of 1914–18 France had at her disposal a quarter of the oil production of Iraq, one branch of the pipe-line from

Kirkuk to the Mediterranean ending at Tripoli, in Syria. In 1945 the production of the United States was 244 million tons, of the Soviet Union 40·9 million tons, of Venezuela 40 million tons, and of Persia 16 million tons. *To these figures should now be added those relating to *synthetic* oil (see p. 167).*

The whole of the present-day story of the exploitation of oil is a thrilling one. Forty years ago Great Britain had, so to speak, no sources of oil, and the two great rivals at that time were the American Standard Oil Company and the Royal Dutch Company of Holland. But by the union of the English Shell Transport Company with the Royal Dutch and the creation of Royal Dutch Shell and its affiliated or subsidiary companies England succeeded in establishing herself even in the United States, becoming, if not the greatest producer, at all events one of the richest owners of oil in the world.

The earliest successes of mineral oil and its wide diffusion were due to paraffin oil for lighting purposes and lubricating oils for machinery. But the *petrol* needed by all the internal-combustion engines of the new motor method of locomotion created a demand for oil commensurate with the increase in the number of motor-driven cars and tractors. Thus a technical discovery had transformed the map of those parts of the globe where men drew from the earth a form of energy hitherto unused because unusable. This was destructive exploitation, dangerous and costly. It is a risky business if ever there was one. The Americans call it 'hunting the wild cat,' and the 'wild-catters' in oil have, to put it shortly, taken the place of the prospectors and gold-diggers of earlier days. Then later the German Rudolf Diesel constructed the first internal-combustion engine to make use of fuel oil, and from being an aid to industry on land heavy fuel oil became also an agent of locomotion at sea.

Great Britain, whose commercial and industrial prosperity during the nineteenth century had been due to her command of coal and her coal policy, realized the danger of the revolution, first scientific and then industrial and commercial, wrought by petrol and fuel oil. Immediately, therefore, she used the most skilful diplomacy, in Mesopotamia and Persia as well as in Central America and Mexico, etc., to establish herself in a predominant position, which, though not apparent from the statistical tables relating to the different countries, was yet one of the leading facts of the situation on the eve of 1940.

South America remains one of the geographical stakes in the game, for there Royal Dutch Shell holds very strong positions. The recent entry of Venezuela, Peru, the Argentine, Chile, Brazil, and British Guiana into the world oil economy is an event of as great importance as the discovery of the first oilfields in the United States, the opening up of of the Baku region, or the very rapid growth of production in Mexico.

The struggle for oil between the Powers is all the fiercer because it is a matter of destructive occupation: the wealth drawn from the earth is not replaceable, so, whether consciously or not, men are dominated by the threatened exhaustion of supplies. Thus the phenomena of mineral exploitation proceed from certain of man's needs or desires; they are based on technical discoveries and equipment; and their ultimate results are certain special forms of human settlement.

The Precious Metals: Silver and Gold

How comes it that desolate regions where vegetation dies and animals themselves can scarcely live have yet managed to attract fairly large populations? If we go back a few centuries, or, better still, if we go down into the holes in the earth that are still open, we shall find the answer there: it is mines of gold, silver, or copper that explain such apparently abnormal populations. (See Fig. 69.)

"Without some powerful attraction," says Reclus,[1] "Cerro de Pasco would have remained what it was in 1630—a solitude traversed only by a few shepherds. But at that date a herdsman named Quicha discovered one morning on his hearth some ingots of silver. Then suddenly appeared the multitude, and the town arose as by a magic spell. Since then its population—largely a floating one—rose and fell according to the output of the mines or the fluctuations of the market."

Oruro, in Bolivia, too, owed its 70,000 inhabitants to its silver-mines, whose exploitation gave way to that of the tin-mines. And it was silver-mines that made the fortune of Potosi, founded in 1545 at the foot of the Cerro de Potosi, which was said to be a silver mountain. So also the extractive industries are primarily responsible for the prosperity of the Mexican tableland: to them it owes its past fortune, and to them it will owe its future success. Albert Bordeaux, a French engineer, recalled on his return from Mexico that "the silver produced in that country is more than a third of world production. Between 1521 and 1905 more than a million tons were extracted, worth 21 or 22 thousand million francs, for down to 1550 silver was worth more than 150 francs a pound, and from then until 1875 upward of 100 francs."

"The Zacatecas district is famous in the history of mines. The veins of silver are sometimes from 100 to 130 feet thick and several miles long. . . . But all wealth of this kind, however great, always comes to an end in time, and Zacatecas, whose population has fallen by degrees from 80,000 to 30,000, has the appearance to-day of what many mining towns will eventually become if they are situated in lands not agriculturally productive: a stone's-throw from its magnificent cathedral and sumptuous theatre there are streets almost entirely deserted. Still more closely surrounded than Zacatecas by a tangled mass of mountains is Guanajuato, whose streets invade all the mountain gullies like the tentacles of a giant octopus. As you climb the hillsides you find that you are gradually approaching what look like real medieval castles—stone ramparts from 60 to 130 feet in height and with enormous buttresses capped by towers and strange-looking frames propping up the walls. It is hardly believable that these are mines. The vein of metal was followed along the slopes at a sufficient height, and as the debris gradually accumulated on the declivities it created actual terraces. These were used for setting up the machinery for treating the ore, and it soon became necessary to strengthen them by walls. Valenciana has the richest church in the country, and its mine was the richest in Guanajuato, having yielded silver to the value of more than a thousand million francs. Then on a mountain on the skyline can be seen the cathedral of la Luz, the centre of a famous district. La Luz was not discovered till two centuries later than Guanajuato, but for some time its wealth was greater than all the rest. In the state of Michoacan, bordering on that of Mexico, is a mining district that is the scene of even greater activity than Guanajuato, and that has recently become famous throughout the whole world for the El Oro group of mines, comprising Esperanza, Mexico, and Dos Estrellas. . . . These new mines, now in the full tide of prosperity, contain more gold than silver."[2]

In all ages, then, so powerful an attraction has been exercised by the precious metals, and gold in particular, as to draw men to these lofty tablelands, and keep them there, where they can hardly procure the ordinary means of subsistence, and where the air is so thin, above 10,000 feet, that they can scarcely even breathe.

In the same way, too, "it was gold that peopled Australia. To the discovery of the goldfields of Victoria and New South Wales must to a large extent be attributed the rapid increase in population that occurred in the middle of the nineteenth century. At the end of that century, in 1890–92, it was still gold that was attracting immigrants to what was hitherto the most neglected part of the country—Western Australia. This sudden outburst of Cyclopean activity in a lonely region presents a fantastic spectacle. At Kalgoorlie, for instance, thousands of workmen are toiling in the workings under a burning sun, blinded and well-nigh suffocated at times by the fumes, the dusty debris of the ore, and the yellow sand of the desert. These human aggregations should not, however, be regarded as towns in the strict sense, for all that they consist of is a couple of wide roads crossing each other and

[1] *Géographie universelle*, vol. xviii, p. 590, quoting Lewis Herndon, *Exploration of the Valley of the Amazon*.
[2] Albert Bordeaux, "Le Mexique pays de l'argent," in *Correspondant*, June 25, 1910, pp. 1168–1184.

flanked by a few brick houses, hotels, and business premises. But the mining population, from the engineer-in-chief down to the humblest labourer, dwells around the mine itself, in temporary quarters—a few wooden shacks and, above all, huts of corrugated iron and canvas, with a chimney outside. It is a vast encampment, a short-period shelter for a population that will disperse as soon as the last seams of ore are exhausted."[1] And all over the globe there are towns born of gold and of nothing else—*ex nihilo*—like Nome or Circle City, in Alaska.

At Cripple Creek, one of the greatest gold centres in the United States, exploitation began in 1891, and men rushed thither, into the heart of the desert. The soil is pierced in all directions by their wells and their trial bore-holes. Two hastily built towns, planned before they were set up, accommodate the hordes of men attracted by the gold, their streets ending up in a suburb of arid waste.

Iron Ores

Iron-bearing regions have on more than one occasion presented striking examples of how rapidly a mineral ore can transform the human map.

"The iron ores known before 1870–71 were found almost exclusively in that part of Lorraine which became the annexed region, but they were of only minor importance when they were handed over to Germany by the Treaty of Frankfort. This phosphoric ore of Lorraine was at that time inferior in quality from the point of view of the production of iron, and it was therefore called 'minette,' or second-grade ore. But in 1879 a new process was discovered by which not only could these phosphoric ores be utilized, but the dephosphorizing process yielded products of the greatest value to agriculture. Thus by a scientific and technical discovery the ores that had been considered the worst became almost the richest and most valuable in the world.

"A new discovery changes the world map of iron in relation to man: it is as if man had created new iron-bearing strata just where this ore of mediocre quality was found. So great was the importance that this Lorraine ore had acquired that every one tried to find more of it. About the same period, ten years after the Treaty of Frankfort, the patient and splendidly fruitful researches of our engineers resulted in the discovery, deep down, of a continuation of the grey liassic schists beneath the great Jurassic plateaux which come to an end opposite the Moselle. And so great is this reserve supply of ore and so great the activity it has given rise to that before the War the Lorraine deposits, taken as a whole, were responsible for four-fifths of the entire production of France and Germany together."[2]

So also the great development of the iron-mines of Swedish Lapland, within the Arctic circle, at Kirunavaara, Gellivaara, and Tuolluvaara, would have been impossible before these discoveries in the treatment of phosphoric ores. (See Fig. 97.)

For the extraction of this ore in a desert region occupied only by the encampments of nomadic Lapps there have been built towns, factories, and a line of railway from Lulea to Narvik which is one of the most northerly lines in the world, and as the Swedish port of Lulea, on the Baltic, is ice-bound for six months of the year the port of Narvik has been established on the Ofoten Fiord, in Norway.

J. Levainville has recalled in his very well-informed book on the French iron industry the situation in France in the days of smelting by charcoal.

The old ironworks were situated in the neighbourhood of forests where fuel was obtainable, but with the employment of coke for smelting the blast-furnaces were built by preference near to the ore, unless this could be cheaply conveyed by water (Pennsylvania and the Ruhr). "In France," writes Levainville, "the age of iron, or, more accurately, the age of steel, which has replaced iron for almost

[1] Bertrand Nogaro, "L'Australie," in *Revue économique internationale*, July 15–20, 1909.
[2] Jean Brunhes, in *Musée Social, Mémoires et documents*, February 1, 1919, pp. 80–81.

all purposes, hardly began before the eighties." French reserves, including the iron ores of North Africa, can be estimated, without exaggeration, at 7000 million tons, or some 57 per cent. of the resources of the whole of Europe, so far as was known in 1922.

But 'mineral resources' is not the same thing as 'organized industry,' and the industrial employment of iron (for making cast-iron, steel, etc.) constitutes a long and essential chapter of industrial geography, or, more generally, of economic geography, which should in principle be introduced here in its logical place.

Various Other Metals; Phosphates and Potash

National problems relating to the most important metals are subordinate to international problems, not only economic, but political as well, for the economy of each country is becoming more and more closely bound up with its financial system and the fluctuations of its exchange rates. In fact, the great mass of metals enter international economic history on the ground floor, if the phrase may be permitted, and attach themselves directly to political history, in which must be sought in part the explanation of fluctuations in their production.

Before 1914 the world production of lead was about 1,200,000 tons, of which 400,000 came from the United States and more than 190,000 from Spain. In 1929 world production was 1,800,000 tons, but in 1932 it fell to 1,150,000, and in 1938 it reached 1,640,000 tons. The United States remain at the head of producing countries with 348,100 tons. Spain has lost since 1922 the second place which she held before 1914. Australia now comes second with 227,000 tons. Mexico has almost doubled her production (207,000 tons), and is followed by Germany and Austria with 11·3 per cent. of total production and Canada with 11 per cent.

Copper is one of the oldest metals used by man. In combination with tin it makes bronze, and the Bronze Age preceded the Iron Age in neolithic times. In 1929 the United States still produced half the copper of the world, with 1,069,000 tons out of 1,981,000 tons, but in 1932 they supplied only 280,000 tons out of a total of 920,000, and in 1938, 570,000 out of 2,040,000. Production has greatly increased in Chile, Canada, and Northern Rhodesia, exceeding 200,000 tons in each case, and the copper of the Belgian Congo (Katanga) amounted to 124,000 tons in 1938, largely exceeding the production of Japan. The increase in the production and use of copper is connected with the increase in the use of electric power. The United States, which had responded to the ever-increasing needs of the allied nations during the 1914–18 War, found themselves faced at the Armistice by overproduction, making their stocks of the metal excessive. These stocks continued to accumulate, till in 1931 the world stock of copper was equal to one year's consumption. Efforts to restrict production have been made in both North and South America: copper production lent itself to speculation on a large scale and to hopes that were often disappointed, and crises came one after another.

Tin, an easy metal to work and used in conjunction with copper for making bronze, has been in great demand ever since neolithic times. It was procured from the Cassiterides, or tin islands, off the Cornish coast, and the tin routes by land and sea are among the oldest in Western Europe. Tin is produced in the greatest quantity in the Malay Archipelago. Production in 1901 was 46,741 tons, exceeded 50,000 tons in 1904, 1905, 1908, and 1913, but fell to 34,000 in 1920 and 1921, rising again to 35,286 tons in 1922 and 96,900 in 1937, this being half the total world production of 200,000 tons. The chief market for tin is Singapore. There are important Chinese tin-mines at Yunnan, whence the ore is sent by rail to Tonkin on its way to Hong Kong. Tin is found also in Tonkin itself, as well as in Siam, India, and the Netherlands Indies. Bolivian tin accounts for one-fifth of the total production, and mines have been opened in Australia and Africa—Nigeria, the Katanga country in the Belgian Congo, and Northern Rhodesia. The principal producer of tin in 1938 was the British Empire.

The use of **zinc** dates only from the beginning of the nineteenth century, before which time it had

been used only in combination with copper in the famous brassware of Dinant, called *dinanderies*. The 1914–18 War showed the predominance of the United States in the production of metallic zinc, which was 567,000 tons in 1929 out of a total of 1,479,000 tons; 190,000 out of a total of 780,000 in 1932; and 406,300 out of 1,580,000 in 1938. The total production of zinc in 1932 was no more than two-fifths of what it was before 1914. There was a falling-off even in countries of great production. From 1919 to 1932, for instance, the share of the United States fell from 66·5 per cent. to 24·7 per cent., and that of England from 5·6 per cent. to 3·5 per cent. In the same period German production fell from 15·3 per cent. to 5·4 per cent., that of Belgium rose from 3·1 per cent. to 12·7 per cent., and that of France from 1·7 per cent. to 6·2 per cent. Poland and Canada, on the other hand, became important producers, each producing 10 per cent. of the total. Production made a new spurt between 1932 and 1938.

The employment of **nickel** in industry is again quite a recent matter, dating from the discovery of the ores in New Caledonia in 1874. The total production in 1937 was 114,000 tons. The two principal producing countries are Canada (Sudbury, in Ontario) with 90 per cent. and New Caledonia with 5 per cent. The Canadian ores are dealt with on the spot and in England, while those of New Caledonia came mainly to Le Havre and were treated in France and Belgium.

Aluminium entered industry only a quarter of a century ago, when it became possible to treat the clays called *bauxite* (from the town of Les Baux, in Provence) in the electric furnace. Bauxite is found in several departments in the south of France, which was until 1914 the principal producing country (58 per cent.). The United States furnished 40 per cent. But in view of the many uses of aluminium and its valuable qualities, especially its lightness, it is sought for in all parts of the world, and total production in 1938 was 581,900 tons. France now comes only fifth, with 7 per cent., after Germany (27 per cent.), the United States (22 per cent.), Canada (11 per cent.), and the Soviet Union (8 per cent.).

The increasingly important part played by **phosphates** in agriculture is well known. In the Old World they are a quasi-monopoly of French North Africa, which in 1913 supplied 2½ million tons out of a total of 3,200,000. "In 1873 the existence of a phosphate zone was noted near Boghari by a veterinary surgeon named Philippe Thomas, who was again the first to reveal in 1885 the existence of the phosphate belt to the north of the Shott el Jerid, in Southern Tunisia."[1] These are the phosphates of Gafsa, which are by far the most important as regards present exploitation. "In Morocco the phosphate zone is known to exist round Oujda, Meknes, and Petitjean. . . . The reserves of phosphates in the Berber country are certainly not less than five thousand million tons —the same as those of the minette iron ore of Lorraine." In consequence of the supplies from North Africa, France is the leading country in the world in the production of phosphate of lime— four million tons in 1936 out of a total of 12½ million.

In 1847 were discovered the **potash** deposits of Stassfurt, in Germany, which are still the most important of all, while fifty-seven years later the unexpected discovery of deposits in Southern Alsace made an addition to the geography of potash that was to be of singular importance, both economically and politically. "Beneath the trees of the forest of Nonnenbruch, between Cernay and Mulhouse, an Alsatian engineer named Vogt was trying in 1904 to find the continuation of the little coal-basin of Ronchamp, near Belfort, and in seeking for coal he found potash. And these Alsatian potash-beds, together with those of Stassfurt, in Germany, now constitute the greatest reserve of potash in the world. The Alsatian deposits are estimated at 1,000,300,000 tons at least, from which 300,000,000 tons of potash could be extracted."[2] In 1938 they yielded 582,000 tons of pure potash. Production at Stassfurt rose from 600,000 tons in 1913 to nearly 700,000 in 1920, 1,780,000 in 1929, and nearly 2,000,000 in 1938. There are deposits of potash also in Poland (100,000 tons), Algeria, Tunisia, Spain, California, Eritrea, South America, and Russia. World production in 1937 was 3,100,000 tons.

[1] J. Levainville, "Ressources minérales de L'Afrique du Nord," in *Annales de géographie*, vol. xxxiii, 1924, pp. 151–166.

[2] Jean Brunhes, in *Musée Social*, pp. 81–82.

Constructive Significance of Destructive Economy

All these manifestations of destructive economy are dependent originally on scientific and technical inventions. They supply to meet man's needs and appetites masses of materials which are in no way subject to the rhythmical action and the limitations of the seasons as plants are. They are, as it were, huge weights of crude materials thrown more or less suddenly and even violently into the scales of human wealth, so that they upset the already unstable economic equilibrium, accentuate political covetousness, and offer unceasing threats to peace by modifying or accelerating the enrichment of some peoples and the impoverishment of others.

But it is none the less true that without these numerous forms of wealth, new and perpetually renewed, which destructive economy provides for man, the material civilization and even the intellectual or spiritual life that we enjoy could not exist, and could not be maintained as they are, even in their most highly intellectual and idealized forms. As for the 'essential facts' in the first two groups of our 'fundamental human geography'—houses and highways, fields and flocks—they are undoubtedly what they have to-day become through the co-operation, direct and indirect, of all these metals and other products torn up from the earth without any return being made to it. What kind of cultivation would be needed for a human race that goes on increasing beyond all measure if there were no fertilizers and no machinery? What kind of food, clothing, dwellings, and communications should we have without destructive economy? What would our very thoughts be like without books and paper?

Destructive economy, then, may have an end and a significance that are *constructive*. It destroys, beyond a doubt. That geographical fact is plain for all to see: in a thousand places it is unceasingly despoiling the earth's crust of wealth which is never, and can never be, restored to it. But though it has far too often been a mere squandering or even plundering of the earth, it has yet procured for man the most effective means and materials for reaching his present stage of incomparable scientific and technical organization of civilized life on the surface of our globe. All the arts of mining, and all the technical and scientific knowledge that necessarily accompany it, have contributed in a marvellous manner to the progress that *Homo faber* has made. It is certainly true that with man's appearance on the earth there appeared also a new geological force—an evil one if it destroys merely for the sake of destroying, but one that is capable of being beneficently used.

The human race, continually growing in numbers, is compelled to dissipate the energy and exhaust the resources of the earth on an ever-increasing scale and by more and more rapid methods, and this is yet another reason why man should exercise the most methodical moderation in this process of using up resources, and regulate this dissipation of energy in a rational and scientific manner.

4. The Principal Type of Large-scale Mineral Exploitation

Coal

It is natural to select for fuller treatment, and as an example of the brief special study, the most imposing type of mineral exploitation, the one that forms the foundation of all industrial development to-day, and the one that has given rise to such intense economic activity that it has often been studied as a strictly economic subject.

(*A*) General Geographical Inquiry

What is Coal?

Characteristics

Coal, the rock that burns, is generally of a fine black colour, often sparkling, and bright when fractured. The usual classification, which is equally scientific and practical, groups the various kinds of coal according to the percentage of volatile substances they contain (hard coal and soft coal).

Origin

Coal is undoubtedly vegetable in origin. There are scarcely perceptible transitional stages, through the various kinds of peat, lignite, and actual coal, between the trees now standing in our forests and the anthracite which is notoriously the richest in carbon.

Formation

There are two opposing theories as to the way in which coal was formed. One is that the sea invaded the realm of the great ferns and other species suited to the warm and very wet climate of the carboniferous period, thus covering with silt the vegetable masses it destroyed and submitting them to a process of maceration away from the air. According to the other theory it was the inland waters in the same very wet epoch that brought about torrential floods which tore from the hillsides the masses of plant growth, sweeping them down and piling them up on the edges of the coast, in the estuaries, and in narrow straits and inland lakes. Notwithstanding such still unquestioned observations, it seems necessary to assume that the majority of the known coalfields were formed in the places where they now are.

From the geographical point of view it is of interest to note that a botanical map of the coal-bearing periods will bear some relation to the present distribution of coal, and therefore to the distribution of such human activity of the present day as is connected with coal. An analysis of this mineralized vegetable substance and a minute examination of the flora of the carboniferous period will enable us to picture to ourselves the appearance of the emergent land and the neighbouring coasts at the time of the formation of coal. Moreover, though most of the coalfields known and worked to-day date back to a geological period that even takes its name from coal—the carboniferous period—the same phenomenon has appeared many times in the course of the earth's history, and we do, in fact, know of coal of very different ages.

Where is Coal found?

There are still many gaps in the geological map of the world, and coal will yet be discovered in many places where it is not at present known.

Though the coalfields of Europe are more or less coincident with the areas of coal production, that is far from being the case elsewhere. Of the two most extensive coalfields in the world, that of the United States yields the greatest quantity of coal mined each year, while the other, that of China, is still largely unworked.

(*B*) The Utilization of Coal

As soon as men knew how to make use of coal, and to the extent to which it can meet the requirements of their activity, they started in certain parts of the world to be drawn

to its locality, and the geography of coal began. Nothing shows so clearly the part played by the soil in relation to man, or the extent to which the connexion between them is the result of a psychological factor—what will be called later, in Bergsonian phrase, "the direction of attention."

The Chinese were acquainted with coal at a very early date. The Greeks knew it, too, and Theophrastus in his treatise on stones speaks of *lithanthrax*, or stone charcoal. No doubt some iron-smelters made use of coal instead of charcoal, but that method was of very limited application. In the Middle Ages we find some traces of coal-mining, notably in the Loire basin, in the Forez district round Roche-la-Molière, and a title-deed of 1321 declares that the lords of the Loire region claimed a levy on all the coal-mines in their territory. In England there is mention of the coal-mines of Newcastle in 1066, but there, as in Belgium, the attempts at exploiting coal were on a very small scale. Coal was not only not in demand—it was actually feared. When the craftsmen of London had recourse to coal in the fourteenth century there were protests by the nobles and the middle-class folk, and Edward I imposed severe penalties on anyone introducing coal into the towns. So also in France under Henry II the shoeing-smiths of Paris were condemned to fines and imprisonment.

It was at the end of the eighteenth century that coal rose suddenly into economic prominence. It owed this rise to steam and iron: to *steam* because it was by far the best fuel for producing steam, and to *iron* because it was by far the best fuel for smelting it. And so the age of steam and iron was the age of coal. At the end of the eighteenth century and during the first quarter of the nineteenth there came a series of decisive events all tending in the same direction. Iron ceased to be employed solely for the manufacture of arms and the products of the locksmith's craft, but was used also in building. It was therefore needed in large quantities, and thus a beginning was made with those bold undertakings that were to reach their highest point in the age of steel. Moreover, steam was the new motive force, and the combination of iron and steam was to remodel the transport industry from top to bottom.

The birth of the new industrial age is very clearly shown by five dates:

1779. The first iron bridge was built over the Severn, marking the beginning of the use of metals in building.
1789. The first use of the steam-engine in the cotton industry at Manchester.
1801. In France Lebon extracted gas from coal for lighting purposes.
1819. First crossing of the Atlantic by a steamship, the *Savannah*, from Savannah to Liverpool, in twenty-nine days.
1825. First railway built, from Stockton to Darlington, and the first locomotive for passenger transport.

Though coal was not the cause of the whole of the Industrial Revolution, it was, and it remained until the coming of 'white coal' at the end of the nineteenth century, a necessary condition of that revolution.

Industrial Customers for Coal

What is coal used for?

(1) To begin with, the *metallurgist* is the greatest customer for coal: the development of iron and of coal are not only parallel but closely connected. Now, it takes about two tons of coal to smelt about three tons of iron ore and produce cast-iron, without counting the quantities needed—certainly very small—to transform a ton of cast-iron into steel; so it is obvious that metallurgy consumes an enormous quantity of coal.

(2) *Other industries* too are large consumers, such as the textile industries, glassworks, sugar refineries, and many others which make use of coal as a fuel. Mention should also be made of the part played by coal in many industrial processes like the manufacture of soda, the concentration of sulphuric acid by the Kessler process, and so forth.

(3) *The Transport Industries.* The railways alone require in France over eleven million tons a year, either in the form of coal itself or of briquettes. This represents at least one-sixth of the total national consumption. The merchant navy too, though far less greedy of coal than the railways, is none the less a very important consumer.

(4) *Domestic Uses.* These may be reckoned in France at about a fifth or a sixth of the total production.

Industrial Offspring of Coal: the Chemical Industries: *Substitute Products

Besides being used as an essential factor in many industries, coal has itself given birth to a group of what might be called daughter industries.

Lebon's discovery in 1801 certainly did not produce all its effects immediately. "It needed prolonged efforts and the intervention of Louis XVIII to overcome the prejudice against the use of coal-gas in place of the old system of lighting by oil."[1] But since that time the problem has completely changed. Formerly the coal was treated in order to extract gas from it for lighting purposes, and all the rest of it was mere residue, starting with coke. To-day the process is reversed: the residue has acquired such value industrially that gas would be made, so to speak, even if it were no longer used for lighting. The industrial fecundity of this black 'burning stone' is indeed both incomparable and incalculable, because from it is obtained coal-tar with all its products—benzine, naphthaline, ammonia, etc., as well as dye-stuffs, artificial perfumes, and pharmaceutical products like sulphonal and antipyrin.

The geographical consequences of the development of the industries derived from coal are in the first place indirect and negative ones, whose influence, though distant, is brutal and very strong, showing itself in certain geographical facts such as the disappearance of cultivation throughout entire regions (for example, madder) and the elimination of all trade in camel's dung, from which ammonia was formerly extracted.

The direct results are geographically less important than might at first be imagined. It is evident that the marvellously fruitful dye-stuff industry has developed particularly in Germany, which is one of the main coal-producing countries, but that is a general connexion, involving no direct localization of the new industry on the coalfield itself. So also lighting-gas is produced for use in towns, so this industry is to some extent independent of the mining areas. In short, though all these industrial phenomena arising out of coal are economically, logically, and historically dependent on coal, their *geographical* dependence is far less.

But what are the geographical consequences of the rise of those industries that make use of coal? Coal is a heavy product that cannot be transported far from its place of origin except at great expense, and since these industries needed it in large quantities, their plants were of necessity established near the coalfields themselves. This essential connexion between coal and its dependent industries held sway almost tyrannically at the beginning of the modern industrial age, and though it tends to diminish as the development of means of transport, aided by coal itself, has enabled the fuel to be more widely diffused, yet it still remains the principal fact in the human geography of coal.

[1] Jules Gay, "L'Acétylène," in *Quinzaine*, April 15, 1897, p. 555.

When coal is itself a form of wealth the industries derived from it depend less on the earth and are less fixed to one spot on its surface. But when coal is an *instrument*, then the industries that make use of it are more dependent on the coal-mining areas. For the geographer, therefore, there is a closer connexion between coal and those industries which use it as a fuel and a source of power than between coal and the industries dealing with coal itself.

*Coal has acquired considerable importance in connexion with the manufacture of *substitute products*, as we have already seen in the case of dyes, artificial perfumes, etc. In fact, coal and wood are the basic materials of the chief synthetic products: from them are obtained in particular petrol, petroleum, and synthetic rubber (*buna*), as well as synthetic fats like oleic acid, starting from the by-product of the distillation of coal or of the manufacture of synthetic benzine.

Substitute products are of two kinds—*natural* products used in place of others, such as acorns for coffee and sugar for honey, having repercussions on the development of certain crops, like beet and soya, and *new* products like those connected with coal, with wood (rayon, cellulose wool), with milk (galalith, artificial wool), with cotton (rayon, glass), or with petroleum (another kind of synthetic rubber, etc.).

Germany's plentiful supplies of coal have obviously enabled her to develop to a high degree the manufacture of these *ersatz* products under the pressure of necessity and owing also to her well-organized chemical industry, her teams of technicians, and her abundance of skilled labour. (According to official figures it takes from 14 to 17 million tons of coal to obtain 2½ or 3 million tons of synthetic benzine.) These new industries may also give value to some coalfields: for instance, as the manufacture of synthetic petrol does not need coal of very high quality, Italy, possessing only inferior grades of fuel, has been able to set up factories for the manufacture of this product.

It is interesting, too, to consider these substitute products in relation to the market and to the industries concerned with the products which they replace and compete with (as we have already done in the case of silk and rayon in Chapter IV, § 5), or with which they co-operate (such as the manufacture of fabrics of artificial wool mixed with natural wool). In this way the recovery and utilization of raw materials is often facilitated (for example, woollen waste). But, generally speaking, the part that they play in a closed economy is principally a temporary one. Their cost of production is high, and they are not always equal in quality to the natural products. (Synthetic rubber, however, being less affected by heat, is suitable for new uses, and is preferable to the natural product in cases where the rubber comes into contact with such things as petrol.)

The manufacture of substitute products was greatly stimulated by the War, because war is a great consumer, and because industry, deprived of supplies from outside sources through lack of transport, is compelled to make the maximum use of local resources to ensure the necessary production. Science makes progress under the stimulus of necessity, and several substitute products will no doubt take their place permanently among the things used by the civilized world.*

(*C*) New Geographical Facts

The Coal-mine

This underground world, made up of hundreds of feet of shafts, miles of 'galleries,' and hundreds of 'faces,' is pre-eminently the typical large-scale mine. Coal is a product that is demanded and consumed in very large quantities; it can be delivered to the consumer without any special treatment, and when consumed it is completely destroyed and has to be unceasingly replaced. For these three reasons the pits dug in the earth in the quest for coal are the largest that are made, and few salt-mines or copper-mines can be compared with them. In this city of gloom all the conditions of life are abnormal. The air must be renewed and the water drained by unceasing toil. Accidents, too, are all the more terrible since men are stationed there in surroundings naturally injurious to life,

and must take unrelaxing precautions against all those dangers that impede their task as powerful digging animals.

These include (1) the threat of being crushed by falls of earth, involving the labour of propping the pit walls to prevent their collapse; (2) water, like the floods of Bessèges and Anzin, etc.; (3) fire, caused sometimes by the mere oxidation of pyrites, as at Commentry, sometimes simply by the presence of dust in the air, and above all by fire-damp; (4) air, which is sometimes charged with poisonous gases such as carbon monoxide, and often at too high a temperature; the oxygen that is indispensable for human respiration must everywhere be supplied to the workers by a system of ventilators acting either as suction-fans or as force-pumps to keep the air in circulation.

The Surface Aggregation above the Mine

The mine, to put it briefly, is a territory in itself, but one in which man cannot dwell. The mine-workers live outside it, and thus a kind of artificial town is created near the pithead, with groups of uniform houses (called *corons* in France and Belgium), forming as it were the necessary accompaniment and distinguishing mark of the working quarters far beneath. But this kind of aggregation can nowadays to an increasing extent be situated at a distance from the mine-shafts, the workers being conveyed to work by trains or special motor-buses.

The Industrial Town

Around the coal-mine are grouped various other industries, for coal is, so to speak, the protoplasm around which there grow up industrial buildings and communications and the life of industry in general.

On the Podèze, near Lausanne, a small seam of lignite occurs in the lignite sandstone. It was formerly worked, and then abandoned on account of the competition of foreign coal. But along with the coal there is also clay, and in 1896 a cement factory was set up downstream in the near neighbourhood. It resumed the working of the seam of lignite to meet its own requirements, and worked the clay as well. So, having both fuel and clay, it needed only to procure limestone. Then the Podèze lignite was no longer sufficient, and other fuel had to be obtained from a distance. But it is none the less true that the isolated seam of lignite was the effective cause of the little industrial unit situated near by.

Geographical observers, by examining small-scale phenomena, can the better grasp the vast reality of the connexions that have determined the industrial aggregations of to-day. There are aggregations of factories of all kinds, brought together by their common exploitation of coal and forming monster towns that work by day and by night. It was coal that started the excessive concentration of industry, and that should be held responsible for the industrial aggregation, even for that part of it which is far removed from the coalfields. In fact, two main types of industrial town should be distinguished—the city that was born *of* coal and *on* coal, and the great historic city that was powerful enough to summon the coal to it and to become an industrial centre in spite of the fact that its coal had to come from afar.

Between these two there is always a physiognomic difference. The first is an indefinite sort of entity—an invertebrate body to which cells are constantly being added. It has no precise centre, and its life comes from elsewhere and goes elsewhere. It is never isolated, but forms part of a larger whole, for there are similar groups all around it: it belongs to a region of industrial aggregations. The second kind of city retains its historic origin, and in spite of its new changes of fortune it retains also a unifying principle and acts as a true centre of attraction. It goes on growing and absorbing

its surroundings. It has a centre, and is not merely one long street, like Saint-Étienne. Not only so, but, curiously enough, it creates a void all round itself, in a very large circle. Though it does not depopulate its surroundings, it does at least prevent the natural and logical growth of certain smaller towns. An urban centre in the neighbourhood of Manchester, Newcastle, or Düsseldorf will be likely to grow and resemble these cities, but an urban centre near Paris or London will be likely to remain stationary, unless it is very near and has grown by direct and immediate contact with the central aggregation—*i.e.*, unless it is situated actually within the zone of extension.

The great city creates a vacuum at its centre, as can be seen in Paris as well as in London. This is not an exceptional and fleeting phenomenon, but a fact of urban geography that is becoming more and more general. A German author, Hermann Schmid, has called it *Citybildung*, or the formation of a 'city,' in the sense in which the word is used in London, and he shows that this progressive reduction in the size of great cities dates only from the middle of last century. Up to 1901 the 'City' of London had lost 118,000 inhabitants, or four-fifths of its previous maximum population. So, too, the centre of Paris had lost 90,000 inhabitants, or two-fifths of its maximum, and the *Altstadt*, or 'old city,' of Berlin 30,000, about half the maximum. At Vienna the phenomenon seems to have become apparent only since 1871, but later on it was very marked.

The Industrial Zone

The industrial city just described shows us also the nature of that belt or spot of industrial life that is the surface indication of the coal-seams lying beneath. Its general appearance is that of the famous Black Country of the English Midlands, without verdure or running water, but with grimy canals, drab houses, roads strewn with black clinkers, a grey and lowering sky, and everywhere smoke. Such towns, with their great slag-heaps, seem at first sight to be ruined areas, having the same sombre hue, often the same aridity, and always the same air of gloom.

Map XXIX is an example of one of these industrial belts or zones in Europe, showing part of the Ruhr basin, including Essen and Bochum. Even before 1914, the period from which it dates, this typical sample revealed the appearance of this industrial area of wealth and activity that plays so prominent a part in the German economy.

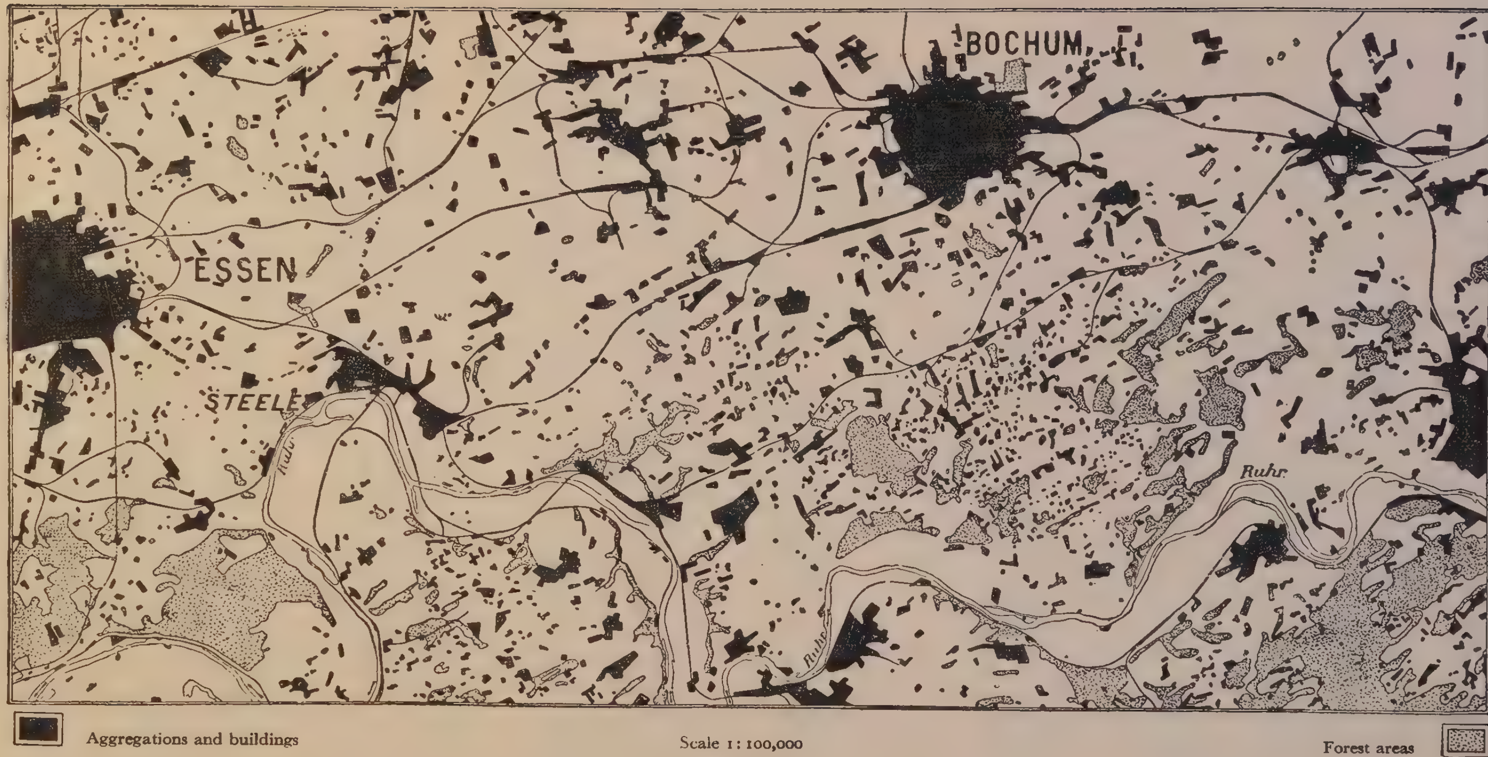
The creation of new human settlements of this kind has been accompanied by many geographical phenomena which we shall have to examine later both regionally and locally. They include the following:

(*a*) The depopulation of the countryside as a result of the attraction of these centres of new life, born of coal.

(*b*) The growth and accumulation of means of intercourse and communication of all kinds.

(*c*) The birth of quite new urban centres and the consequent peopling of areas hitherto uninhabited, as, for instance, the Birmingham area, the Tarnowitz plateau, the district of Montceau-Blanzy in Central France, the creation of Middlesboro in the Kentucky mountains, and similar phenomena in Russia and Siberia.

(*d*) The displacement of the historical and economic poles of activity in the case of both towns and countries. For example, (i) Newcastle, a great coal town, has become a very important centre, while towns without coal, and therefore not industrialized, have lost their former standing and influence. Constantinople, without a single factory chimney, was the third city in the world in 1870, whereas in 1912 she was no higher than fourteenth. (ii) There has been displacement of activity in England in favour of the coal-mining areas (see below), and in the United States there is the growing importance of the south, while in Europe the coal countries have acquired great power at the expense of those of an older civilization on the Mediterranean. *Note, too, the industrialization of the Soviet Union, including the Urals, Siberia, Central Asia, and the Far North. This growth and eastward movement have been intensified by the recent War.*



Map XXIX

How the Growth of an Industrial Zone is indicated on the Earth's Surface: a Portion of the Ruhr Basin

I have intentionally put into diagrammatic form the main facts of human settlement in this small part of the Ruhr basin, based on the Essen and Bochum sheets of the German 1/25,000 map. Between the two first-rank industrial aggregations, Essen and Bochum, the houses are multiplying and the little groups of houses are drawing together, almost touching one another, tending to form what we have called an industrial belt. Note also the almost regular spacing of the second-rank aggregations (for example, Steele) on the flanks of the winding valley of the Ruhr. In this area, once a continuous belt of forest, the building of houses has caused the trees to be felled, so that the forest is being increasingly broken up, though its general outline can still be recognized on both banks of the river. The only roads marked on this diagram (by black lines) are railways, of which there is already a close network.

*This map appeared in the first French edition of *La Géographie humaine* (1910), and dates therefore from before the 1914–18 War, but we have retained it none the less, as it is very illuminating, and the facts it displays have become even more marked since that date. One consequence of this intense concentration is that these zones have been found very vulnerable to large-scale destruction, and the entire region of the Ruhr lost an important part of its human, urban, and industrial potential under the air bombardment of the allies. But the coal will still be there to aid its recovery (in accordance with international decisions).*

Coal, then, has been the most active of the causes determining urban centres, or what might be better called urban belts or zones.

Such, then, are the most general characteristics of the human phenomena that result from the exploitation of coal. There are many other geographical cases presenting varying combinations of the mining or industrial way of life with the rural way of life. Andrée Choveaux has described and analysed (in *Annales de géographie,* vol. xxi, 1922, pp. 215–233) the Forest of Dean, a small English 'natural region,' on the borders of Wales, consisting of a wooded area jutting out into the middle of a plain. "The Forest of Dean," says this writer, "after being one of the leading metallurgical areas of Great Britain until the end of the eighteenth century, has to-day become almost entirely a coal-mining region." To the primitive way of life of the woodcutter has therefore been added that of the "miner forester." In the coal basin of the Saar, a much more extensive wooded area than the Forest of Dean, the population, having grown continuously, has retained a measure of homogeneity and kept some of its rural characteristics: "even to-day it is common enough to see the older man tilling the family fields while the younger ones, who live with him and occasionally lend him a hand, work normally in the mine."[1]

(*D*) Regional Geography of Coal

In a complete study of coal this would be the place for an inquiry into the principal regions in which coal is worked.

Coal in Great Britain

Throughout the nineteenth century, down to 1899, Great Britain was the greatest coal-producing country, but to-day the production of the United States is greater. There are two Englands—the old and weathered massifs of the north, centre, and west and the great Tertiary south-eastern, or London, basin. It is in the latter, a land of green woods and meadows and gently rounded hills, that the chief development of historic England has taken place, while in the more mountainous north-west, a less kindly land with a more rigorous climate, the inhabitants until the eighteenth century were hillmen pure and simple.

Coal, which was formed around the ancient massifs, is distributed in four principal areas as follows: (i) the Northern basin; (ii) the Midland basins; (iii) the Welsh basin; (iv) the Scottish basin, in the great east-to-west gap that separates the northern highlands from the southern. But it is impossible to describe the geography of coal in Great Britain without reference to London—a historic city turned industrial.

Though now exceeded in size by the urban aggregation of New York, London has not abandoned its claim to be still the leading entrepôt market in the world. In order to remain a great port it has become a great industrial city. Industry did not come to it unsought, but was brought to it by man. Until quite recent years London was the most gigantic example of the monster urban aggregation: in 1938 it had 8,575,000 inhabitants, far more than the combined population of two such countries as Norway and Denmark, and twice the entire population of Switzerland, which was 4,000,000 at the 1939 census. And this vast multitude was congregated at a single point in space.

Now, London in 1801 still had less than a million inhabitants—958,000. London had no coal, so had to attract the coal to it, taking advantage of long-standing relations between Newcastle and the port on London river. As early as 1750 no less than 783,341 tons were transported from the northern coalfield to London, and forty-five years later, in 1795, this tonnage had risen to 1,126,893.

The coming of the age of coal may be said to have changed the whole of England's

[1] C. Robert-Muller and R. Capot-Rey, "Dans les mines de la Sarre," in *Annales de géographie,* vol. xxxiii, 1924, pp. 130–150.

historic activity. Apart from London, all the cities of any importance are in the coal-bearing zones, and a map showing the density of population will reveal that the points of growth are the London suburbs and all the coal counties.

Mining and industrial Britain had succeeded, by means of coal, in obtaining raw materials from all parts of the earth and forcing her manufactured products on the whole world. In this way she had set up in her own country world markets for a great number of commodities, and for decade after decade these markets enjoyed an effective monopoly. But "the main thing," says Siegfried, "is to know whether the future distribution of industrial production in the world will continue, by a paradoxical kind of division of labour, to involve the existence of Great Britain as one gigantic factory and an entrepôt market of unprecedented size."[1]

Coal in Germany

The thing that has made Germany's economic power is the geographical coincidence between her historical development and her industrial development due to coal. Whereas coal-mining Great Britain was separated from the England of history, the result of the separation being a real economic and even political revolution, the coal regions of Germany are more or less superimposed on the old historic regions. Though the exploitation of coal and industrial activity began later in Germany than in England, the former benefited to an extraordinary extent by this fortunate coincidence, of which the following are some of the chief geographical features:

The old mountain country of the Hercynian zone is bordered on the north by the great German plain, the narrow prolongation, as it were, of the vast flat region of Eastern Europe. This North German Plain is covered with glacial deposits, lakes, and marshes of all sizes, the ground irregular, confused, covered with heaths and moors, pine-forests, and wet peat-bogs. In short, it is a region ill suited to human settlement and refractory to intensive exploitation. In the south this plain comes into contact with the mountains in a series of loops, advancing in three enormous 'gulfs'—the double gulf of Cologne and Westphalia; the gulf of Saxony, with Halle and Leipzig; and the Silesian gulf, with Breslau. There are also the 'gulfs' by which the rivers slip through the mountains to reach the northern seas—the Rhine; the Saale, Mulde, and Elbe; and, lastly, the Oder.

Along this borderland there is naturally a series of towns with a historic past, making it a human and urban borderland of great importance. Such towns are Cologne, Münster, Osnabrück, Minden, Hanover, Göttingen, Magdeburg, Halle, Leipzig, Dresden, and Breslau.

Now, this very zone of contact, and especially the three 'gulfs,' are not only rich in land suitable for cultivation (silt and loess), but at the same time well furnished with natural means of communication, and, in the mountainous parts, plentifully provided with pure water, timber, and metalliferous deposits.

Owing to a geographical phenomenon similar to that which accounts for the coal deposits in Great Britain around the ancient massifs, the coal in Germany is likewise concentrated round the old massifs of the central and southern parts of the country. But whereas this borderland had little life in it, and was, indeed, almost uninhabited before the fourteenth century, three of the most important German coalfields coincided—not without reason, of course—with the three great 'gulfs' of historic activity. As time went by these ancient centres found themselves too isolated. In particular they were bounded on the north by the barren and inhospitable plain that separated them too completely from the Hanseatic ports and placed a barrier difficult to surmount between industry and commerce. In the eighteenth century Cologne fell away from its former magnificence, Dresden was nothing but a museum, and Breslau had long been in a state of decline. But at that precise moment of history there occurred a group of human events which were destined to prepare and

[1] André Siegfried, *L'Angleterre d'aujourd'hui, son évolution économique et politique* (Paris, 1924), p. 187.

encourage, as it were, the task that was accomplished later by coal. There was a great historic interlude that would prove, if proof were needed, that a piece of the earth's surface is not the result of natural forces alone, but also of man's intelligent co-operation with nature. For in the middle of this moist and marshy North German Plain, and stretching from west to east, is drawn a trench or rift that marks a stage in the retreat of the great Scandinavian ice-cap. Unfortunately the rivers and their main tributaries—the Vistula, Oder, and Elbe—only partially follow this transverse rift, and there is no watercourse whose flow marks uninterruptedly this striking physiognomic feature of the glacial plain. It fell to the Great Elector and Frederick II to begin the task that has been completed only in our own day—that of constructing a continuous system of waterways from east to west, from the Vistula to the Oder, the Elbe, the Ems, and the Rhine.

Berlin was created almost entirely in the seventeenth and eighteenth centuries at a point where the low glacial ridges on the north and south draw near together to form a kind of defile through which flows the river Spree. It is a great river centre set right on the water route that runs from the Russian frontier as far as the Elbe and Hamburg. Being as it were a kind of inner harbour for Hamburg, established in the midst of an uninhabited hinterland, it caused this region to become a centre of communications and formed a connecting-link between the great Hanseatic ports and the historic cities of the three southern 'gulfs.' Thus everything was ready, it seems, for the exploitation of coal to produce its maximum effect.

The whole of modern Germany, a land of industry and commerce, is explained by this superposition of industrial coal-mining activity on the older historic activity of the towns. And all this would have been impossible, or, at any rate, would not have reached such heights, without the creation of this central river artery joining two great cities together, one primarily industrial (Greater Berlin, with a population of 4,332,000) and the other mainly commercial (Hamburg, with 1,682,000 inhabitants).

PROGRESS OF POPULATION

(*in Thousands*)

	After the Thirty Years War	1801	1850	1895	1900	1910 (including suburbs)	1930	1939
Berlin	6	172	415	1677	2500	3430	4550	4332
Hamburg	—	100	161	625	706	936	1079	1682

A map showing the density of population in Germany reveals the extent to which economic life has been particularly concentrated and developed in those parts which we have called the three historic 'gulfs,' and which are also the coal-bearing gulfs. So also a map of Europe as a whole shows the general prevalence of human settlement along the great fringe that starts near the Donetz coalfield and ends with the Welsh one—a huge trail of factories and an almost continuous belt of close-packed humanity.

(*E*) Other Countries and Other Facts. The Transport of Coal

The features that characterize the coalfields of Great Britain and Germany can be observed also in almost all the areas where coal is worked, and similar regional studies could be made, noting both the principal general phenomena and those peculiar to this or that region. Thus in connexion with the coal-mines of the French departments of Nord and Pas-de-Calais it would be important to analyse the relations between the coal mined in these departments and Paris, the industrial and commercial centre; such as the growth of traffic on all the Nord canals, the navigation of the Oise, and even, indirectly, that of the lower Seine, and the supremacy of Paris as a river port.

As a typical example of a coal-mining and industrial area at a distance from the sea we might

take the Saint-Étienne basin, or even that of Montceau-Blanzy and le Creusot, in a narrow depression between the two massifs of the old districts of Morvan and Charolais. In this latter case we should find that coal is now merely a subsidiary industry of little importance compared with metallurgy, and we should see, too, how the Canal du Centre was constructed too soon, before the industrial development of le Creusot, so that its course lies too far from the active centre of the present day to be really useful to it.

The exploitation of coal has in very truth caused an advance of the limits of the inhabited earth towards the Arctic regions: thus at Svalbard, in Spitsbergen, where no human beings dwelt before the beginning of the present century, the Norwegians have sunk coal-mines and established permanent settlements of men and women.

But in human geography coal must be followed up not only beneath the earth, as, for instance, under the Campine and the Netherlands, but also wherever it is transported by land or sea. English coal must be followed to Marseilles and Genoa, where it will meet in the one case French coal travelling laboriously over our internal railway system, and in the other German coal that has come through the St Gotthard tunnel, in both cases creating industrial centres on account of the ease and cheapness of maritime transport. These centres may seem in theory to be far distant from coal, but, being near the sea, they are actually close to it. Next, Australian coal must be followed from New South Wales as it journeys far and wide all over the Pacific, and the coal of Japan and Tonkin on its voyage to Shanghai. It must be observed, too, how Indian coal has enabled native industries like cotton and jute to be developed, and how that of Kusnetsk, in Siberia, has made possible in recent years the creation of such great industrial towns as Magnitogorsk. And lastly it is important to realize the stimulating influence of coal wherever it is sent merely to be stored for refuelling purposes, like the islet of Perim, living on the coal of Cardiff, and Algiers itself, which owes much of its present importance to its function as a coaling-station. It would be a hard task indeed to draw in outline a general picture of the circulation of coal, a very large part of which is carried by tramp steamers as ballast, at reduced rates.

The consequences of the 1914–18 War were incalculable. The creation by the United States of an enormous merchant fleet led them quite naturally to make use of coal as valuable ballast in the English manner, and so the most formidable producer in the world increased its exportation of coal to a notable extent, though only temporarily. Since the world economic crisis coal exports have suffered everywhere a considerable decline, and the more recent War and its after-effects will again change the whole situation. But enough has been said to call attention to all the various questions, of a strictly geographical nature, arising from coal, that great revolutionary force which has made and unmade cities, often showing itself mistress of the economic and political destinies of provinces and states alike, and, for good or for ill, a veritable remodeller of the face of the earth.

(*F*) The Special Geography of the Various Kinds of Coal

There is coal *and* coal, and with the progress in means of transport which puts coal at the disposal of all countries and all industries, as well as the improvement of processes for utilizing all its products and by-products, a special geography for each kind of coal becomes more and more clearly defined and indispensable.

The boilers of the vast majority of ships in all naval and merchant fleets have been constructed with a view to burning a medium coal, like that of Cardiff, neither too hard nor too soft, and before the 1914–18 War and the changes resulting from the world

economic crisis they had the advantage of obtaining Cardiff coal everywhere, and at a reasonable price. The consequence was that even after the War, when Cardiff coal became dear, very many ships found themselves compelled to buy it at any price, or, alternatively, any coal that tried to compete with it had to have similar qualities: Cardiff coal, for instance, contains from 12 per cent. to 18 per cent. (an average of 15 per cent.) of volatile matter, it burns well on the fire-bars, and it leaves very little ash.

In Japan coal is obtained in abundance in two of the large islands—Kyushu, the most southerly, and Hokkaido, the most northerly. But this coal is too hard, containing up to 30 per cent of volatile matter, and gives too long a flame, so that in ships' boilers as at present constructed too much of the heat goes to heat the smoke-stack instead of the boiler, so it has to be mixed with a soft coal. The coal of Hongay, in Tonkin, on the other hand, is very soft, and to make a fuel suited to the needs of ships' boilers an attempt has been made to mix it with the tar that results from the distillation of coal—but the tar had to be brought from France!

There is not much coal in France with exactly the qualities of Cardiff coal: before the 1914–18 War the coals of Anzin and Noeux were made into good briquettes, giving very little ash, but they were reserved for the use of destroyers.

So, too, in the case of domestic heating systems, especially those using anthracite, there must be exact agreement between the construction of the apparatus most commonly used and the size, as well as the quality, of the fuel.

(*G*) Statistics of Production

After all these regional, local, and qualitative analyses let us look at the general economic aspect with the aid of figures, for after the qualitative study comes the quantitative, and after the geographical the statistical. The production of coal, after making considerable progress, has diminished, at first because of the restriction of industrial needs in consequence of the crisis after 1929, but owing also to a better utilization of fuels and to the growing competition of petroleum and hydro-electric energy.

The consumption of coal-produced energy in France fell from 87 per cent. of the whole in 1913 to 84 per cent. in 1929 and 76 per cent. in 1935. From 1929 to 1935 the proportion of hydro-electric energy rose from 6·7 per cent. to 9 per cent., and that of petroleum from 6·1 per cent. to 10·7 per cent. These other sources of energy in competition with coal are less burdened with labour costs and easier to transport.

Production of Coal (including Lignite) in the Principal Producing Countries
(*in Millions of Tons*)

	1921	1923	1929	1932	1938
United States	457	581	552	322	352·3
Great Britain	165	283	262	212·6	232
Germany (including lignite)	259	180	337	227	381
France	29	38·5	54	46·2	46·5
Poland (including Polish Upper Silesia after June 1922)	7·8	36·1	46·2	28·8	38
Japan	27	27·8	34·2	28	46 (1937)
Belgium	21·8	22·9	27	21·4	29·5
China	20	21·3	16·5	19·3	15 (1936)
India	19·6	19	23	18·9	25·6
Canada	13·4	14·5	12·2	7·5	10
U.S.S.R.	7·5	11·7	41·6	63	133

In 1938 the Union of South Africa and Czechoslovakia produced respectively 18·6 and 12 million tons of coal.

TOTAL WORLD PRODUCTION OF COAL (INCLUDING LIGNITE)
(*in Millions of Tons*)

1890	470	1919	1080
1900	696	1921	1120
1906	893	1929	1557
1907	1010	1932	1000
1909	1098	1936	1450
1913	1248	1937	1542

For the first time in 1907 the production of coal and lignite exceeded a thousand million tons, and in 1929 it reached the record figure of 1557 million tons.

Over against this gigantic weight of coal let us set the total weights of a few other heavy products of the extractive industries:

	1908	1909	1921 (*in Millions of Tons*)	1932	1937
Sea salt and rock salt	14·3	14·8	18	25	37
Petroleum	36·3	37·2	109	174	285
Iron ore	111·6	134·8	125	31·5	75
Coal and lignite	1060	1098	1120	1000	1542

Comparative world statistics undoubtedly confirm the exceptional value of this last type of extractive industry.

Chapter VI

SPECIAL STUDIES IN HUMAN GEOGRAPHY

FIRST EXAMPLE: 'ISLANDS' IN THE DESERT—THE OASES OF SOUF AND MZAB, IN THE ALGERIAN SAHARA

1. Human Islands in Stony and Sandy Deserts

In our detailed analysis of the 'essential facts' divided into three groups—unproductive, productive, and destructive occupation of the soil—we arranged them in logical order. It is as well now to proceed to the converse process of synthesis, giving examples of special studies in which the facts of human geography are considered in all their natural complexity. The classification of the 'essential facts' that makes analysis clear and easy is not meant to be rigidly imposed on all expositions of human geography, like a kind of uniform priestly robe. It is a method, and therefore only a guide. Geographical work by way of studies should throw as much light as possible on life as it actually is, with its own physiognomic aspect in each kind of natural setting. Thus in some cases the dominant fact will be the field, in others the flock; it is fishing in one place and mining in another; the house here and the road there; and so forth.

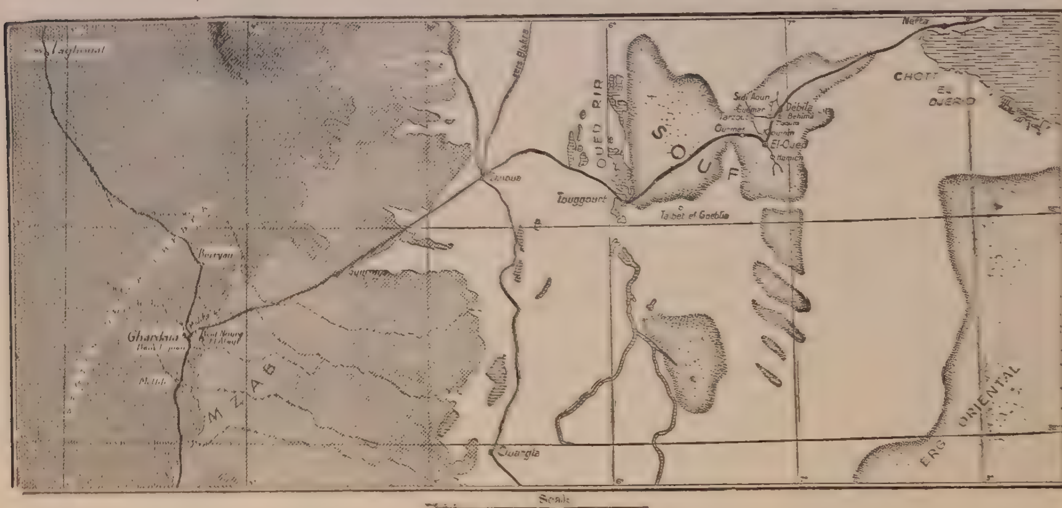
In starting these studies in synthetic human geography with the simplest cases—little isolated groups of human beings confined to 'islands' in the desert or the mountains—we shall endeavour to place always in the forefront of our exposition the most symptomatic and significant of the 'essential facts.' Thus in dry regions where irrigation is the cause and condition of the sedentary life the watered garden is, and should be, 'at the root' of all things, in both senses of the phrase.

The great depression called the Wadi Rir extends from the Shott Melrir to Tougourt, and then continues, bending south-west, to Wargla. On both sides of this depression, where water is either quite near the surface, in the form of 'shotts,' or is drawn from lower levels by artesian wells, there stretch two areas, differing greatly from each other in nature and appearance, but alike in being barren and inhospitable. On the east lie the great sandhills that form the northerly prolongation and boundary of the eastern Erg, and on the west is the calcareous and rocky Chebka, with a surface of *hamada*: the one is a desert of sand, the other a desert of stone. (See Map XXX.)

Two different but equally independent and original peoples have been able to settle, to live, and to create and maintain oases in the midst of these two regions—the oasis of Souf among the sandhills and that of Mzab in the middle of the Chebka, the former with 47,700 inhabitants and 441,800 date-palms, and the latter with a population of 31,000 and 259,875 palms. These are considerable numbers for people and plantations set right in the midst of the desert. And these oases are **veritable masterpieces in the art of cultivation,** absolutely unbelievable at first sight, for they were made in the desert by the hands of men who had at their disposal neither running water nor wells. In both cases this result has been achieved by unremitting toil of extraordinary intensity: in the Souf perpetual war has to be waged against the sand-raising winds, while in the Mzab unceasing labour is needed to procure the water that is indispensable. In short, these two groups of oases, so unlike each other, are two extreme types of careful and fruitful cultivation in exceptionally unfavourable conditions.

2. The Sandhills of the Souf; Gardens, Houses, and Towns; the Soafas

The Souf oases, set right in the heart of the sandhills, form a little world of their own, lost in a waste of sand. Their surroundings must be known if the exceptional nature of these oases is to be realized. The sandhills must be traversed to estimate at their true value the very remarkable gardens of the Souf, irregularly distributed along one of those wide belts in which the sand, though piled up to a great thickness, does not impart to the surface the pronounced relief of the higher sandhills. The Soafas have settled in the midst of the sands, where they have laboriously made their gardens of date-palms by digging down through these masses of sand to a depth of many feet. In order to plant their trees they have removed the sand nearly as far down as the moist strata.



Map XXX

Oases of the Souf and Mzab

The unshaded portions are the areas below 650 feet, and the stippled patches are the chief regions of sandhills. The light shading marks the areas between 650 feet and 1625 feet, and the heavy shading those between 1625 feet and 3250 feet.

and it is the roots of the palms themselves that seek for the underground water by plunging into the water-bearing strata beneath. Hence arises the strange appearance of the gardens of the Souf. (See Fig. 110.) But there is always the risk that the sand may overwhelm them again, for the dry desert sand is so mobile that its fine grains are swept down to the bottom by the slightest breath of wind, and in spite of the little walls or palm-stalk fences, the garden would soon be covered up and the slender palms buried to their crowns if the Soafas did not toil unceasingly to put the sand back on top of the steep banks. (See Fig. 111.)

On the other hand, the Soafas have no need to concern themselves with the labour of watering, for there is no running water in the Souf, nor any gushing artesian wells: it is the trees alone that draw the water that man cannot see. Only at long intervals on the sides of the garden banks can be seen the wells whose waters meet the needs of men and beasts or are used for watering a few secondary crops. The water is raised from them sometimes by a simple leverage device called a *khotara*, but sometimes the wells have not even that, and the water is raised by a chain. This latter method, rather unusual in Saharan oases, adds yet another original feature to the Souf.

The date-palm is the principal crop in the Souf more completely than anywhere else, and the

most important group of these strange palm gardens, which might be called 'sunken gardens,' is around El Oued (El Wad).

It seems to be the case that wherever man devotes meticulous care to the cultivation of the soil he shows the same care in other things, and particularly in the art of building. **If there are few oases in the Sahara where cultivation calls for such assiduous toil as in the Souf, it is certain also that there are no towns or villages in the Saharan region where the houses are so carefully built—we might even say so elegantly built—as at El Oued, Kouinin, and Guemar.** It is as well to remark also that the very original features of the Souf houses are dependent on materials at the disposal of the Soafas. Stones are a rare commodity in this land of sand, and the only ones to be found, engulfed, as it were, in this sea of sandhills, are very flinty ones, which have the advantage of containing enough sulphate of lime to make a very good plaster for setting them and joining them together.

In all lands, but particularly in the Saharan oases, the hardest part of a dwelling to build is not the walls, but the roof. (See Chapter III, § 1.) The walls may be built simply of bricks made of sun-dried clay, and they often are, as at Biskra, Laghwat, and Bu Saâda. But the top covering of the house is a much harder problem to solve. Luckily the trunks of palm-trees divided into three or four pieces can be used to join two opposite walls, and this skeleton covering, in conjunction with palm-stalks and dried earth, often solves the roofing problem in the Southern Algerian Sahara, and also in Egypt. **But in the Souf the native stone has made it possible to build not only very substantial walls, but hemispherical domes on top of them as well, so that all the houses, even the humblest, are thus finished off in true architectural style.** It can well be imagined what skill is required of the builder to get the shape of the dome so perfectly.

Such, then, is the typical house that characterizes all the human settlements in this group of oases, and it obviously adds a new and striking feature to the landscape of the Souf, for all these houses, consisting of cubes of masonry, capped by perfect hemispheres, are aligned with a geometrical regularity that is amazing, especially in the desert. (See Fig. 112.) It has been said of these aggregations that they resemble bee-hives, and with some truth, for from a distance they do look like cities of hives—huge colonies of bees. These communities accompany the gardens, the chief dwelling centre being near to the principal group of gardens at El Oued.

The Saharan peoples have been divided, quite rightly, into the two opposed and often hostile classes of nomads and sedentaries. But it goes without saying that along with the exclusively sedentary and the exclusively nomadic groups there are certain others that possess some characteristics of both, and in the Souf oases there is a fairly plentiful assortment of these intermediate cases. There is a small detachment of pure nomads, belonging to the great Chamba family, who come each year and settle near the domed shops of Hamich. These Chamba are owners of several gardens. This group of nomads in the Souf has not planted any palm-trees, but has bought them: they are still true nomads, therefore, though they possess palm-trees and have had storehouses built for their use, called *déchéras* and similar to the dwelling-houses of sedentary peoples.

The Asheshe and the Messaaba are nomad tribes that have become partly sedentary, and to-day they are cultivators and herdsmen, owning both gardens and flocks. These two tribes form the bulk of the population of El Oued. An important tribe that is entirely sedentary, that of the Ouled Saoud, has peopled almost all the other centres in the Souf, being established in groups at Kouinin, Ourmes, and Zgoum, as well as at Guemar, El Behima, and Debila. These sedentaries are primarily cultivators, but merchants as well: the people of Guemar make the famous Souf carpets, and take them to the Tell for sale.

Lastly, many inhabitants of the Souf, finding no way of making a living in a region where natural conditions make cultivation so hard, emigrate to the Tell—to Constantine, Philippeville, or Bona.

Thus the Souf oases are a complete whole in the matter of Arab tribes: they contain some purely nomadic Arabs, some nomads who have but recently become sedentary, and, of course, a majority of pure sedentaries.

The administrative organization of the Souf does not rest entirely on its division into tribes, nor yet on its division into inhabited centres. It still depends on local conditions, without aiming

at uniformity. The table below shows the system in force in 1899. Since that date the administrative organization has been modified by new decrees, and new censuses have given more complete results. But the facts given here have lost none of their significance, for the position of each group in relation to the whole has undergone no appreciable change. By the courtesy of Captain Davey, of Verville, and the great kindness of Lieutenant Gascuel, we have been enabled to consult the records of the Arab department for the year 1899, and to take from them some interesting figures relating to the number of domestic animals and palm-trees in the possession of each of the groups.

Population	Tribe	Camels	Sheep	Goats	Palm-trees
4,732	Asheshe	2,987	14,575	14,903	38,086
4,496	Messaaba	2,123	8,225	8,305	27,107
7,386	Ouled Saoud	375	—	2,012	65,085
	Independent Sheikdoms				
3,682	Guemar (*ksar* = fortified place)	509	346	1,118	37,005
1,197	El Behima (*ksar*)	24	29	214	13,912
854	Debila (*ksar*)	63	—	229	9,307
273	Chamba (tribe)	868	1,275	1,083	1,650
22,620	Totals	6,949	24,450	27,864	192,152

A few comments on this table will not be without interest. The Ouled Saoud and the people of Guemar, El Behima, and Debila are the sedentaries, who numbered 13,119 and had only a thousand camels between them (more than half of which, it will be seen, belonged to the people of Guemar, who are the most commercially disposed and have most need of camels for transport purposes). But against this they had 125,309 palm-trees, which is nearly three-quarters of all the trees in the Souf. Conversely, the small group of Chamba nomads possessed only 1650 palms, but 868 camels. As for the Asheshe and the Messaaba, who form most of the population of El Oued, they are, as we have seen, an intermediate type—nomads who have become partly sedentary, both cultivators and herdsmen. They numbered 9228, and besides owning some 65,000 palm-trees they had fairly large flocks as well—upward of 5000 camels, 22,000 sheep, and 23,000 goats.

The whole of this assemblage of differing peoples, however, derives certain similar characteristics from its uniform geographical setting. Thus all the inhabitants of the Souf are commonly known as 'Soafas,' despite the differences between the various *ksars* and tribes. The sand that surrounds the Souf oases remains a factor whose tendency is, if not to unify men, at least to draw them together and unite them.

3. The Chebka of the Mzab; Wells, Gardens, Houses, and Roads; the Mozabites

The sandhills, being reservoirs of water, have in some parts a fairly abundant vegetation and are actually pastures for camels and sheep. When we leave them and enter the stony desert of the *hamadas* we experience a strange sensation, for we seem to be leaving a fairly hospitable land and to be confronted for the first time by the real desert. On the huge and shapeless stone slabs of the *hamadas* we no longer see any thick tussocks of grass, and at the bottom of the dry *wadis* there is nothing but a few scattered blades to provide a scanty diet for the sheep, which themselves find it hard to exist, so that their number is very small.

The Chebka of the Mzab consists essentially of a vast slab of cretaceous limestone, with a yellowish-white surface, rough and bare. This platform, as it were, has been eroded and weathered by water, especially to the north-west, so that it appears to be cut up into a confused and irregular set of steep-sided gullies. The natives have naturally likened these to the tangled meshes of a net, which

is what the word *Chebka* means. **To find oases in the middle of the Chebka seems even more astonishing than to find them among the sandhills of the Souf.**

The Chebka is from 2000 to 2300 feet above sea-level, whereas the Souf is nowhere higher than 325 feet. But the Chebka is very much higher in relation to the depression of the Wadi Rir and the deep levels that mark this depression. (See Map XXX.) It is fortunate that in the Mzab plateau a few reserves of water have remained, deep down in contact with the Turonian limestones and the underlying Cenomanian marls.

The Beni Mzab, heretical Moslems, settled in the middle of the Chebka when defeated and driven out, and had the tenacity, as they still have the energy, to draw water even from these depths—100 feet, 130 feet, 160 feet, and even more. **Since water is necessary to all life and all cultivation, and to procure it is man's first and most essential task, it is with the wells ('hassis') and gardens that any study of human geography in the Mzab oases must begin.**

The means employed for raising water are well suited to the conditions of the region. The depth is too great for the bascule principle to be adopted, as in the *khotara* and the Egyptian *shadoof*, so recourse is had to a rope passing over a pulley, but instead of raising the water-skin by coiling the rope on a winch, a very tiring process which could be done only by a man, the rope is pulled by walking away from the well, and this can be done just as well by an animal as by a man—by an ass or camel as well as by a Negro. The deeper the well the longer the track that the man or beast must tread, and the length of this track measures horizontally the depth of the well. (See Fig. 113.) The Mozabites make this track slope a little, which slightly reduces the expenditure of effort, as the rope-puller walks downhill in drawing up the water-skin.

At some places these deep water-bearing pockets are particularly few and far between: at Beni Isguen, for instance, they are much less frequent than at Ghardaia—only three or four wells that yield water at all times, even during drought, and these belong to several owners, who sell so many hours of watering to other owner-cultivators. These wells are in constant use, even during the night, the water being drawn up by two beasts moving at a trot, along with their driver.

If we wish to understand the amount of labour entailed in procuring the life-giving water, despite the ingenious character of the method employed, we must not forget either the weight of the water-skin holding some ten gallons of water or the length of time that the process takes. In the Mzab it is vitally necessary to go on drawing water unceasingly to irrigate a thirsty land that quickly drinks up all that is given it. The Mozabites fight their hardest against leakage by limewashing the little channels, called *seguia*, that carry the water from the wells to the palm-trees, and where water is most scarce it is husbanded with the most jealous care.

But besides wells the Mozabites build also fine barrages of masonry for obtaining and distributing water. Indeed, they know the value of water too well to neglect any single means of getting it. When I visited the Bouchen barrage, above the Ghardaia oasis, the reservoir was completely dry, as it often is, but everything is constructed exactly as if it was to be in continual use. An underground passage equipped with manholes, after the manner of the *feggaguir* of the Tidikelt district, conveys the water from Bouchen, when there is any, right into the oasis, so that this exceptional and short-lived boon is enabled to flow in a controlled and methodical manner. How unrelenting is the toil involved in such undertakings as these! And, it should be added, how costly is the cultivation that results from it! The Mozabite is a skilful gardener who grudges neither time, nor care, nor labour to his crops.

In the Mzab, as in the Souf, the price of a tree bears no relation to what it yields, but depends on the labour that it has cost and that it stands for. A palm-tree in the Souf before the 1914–18 War would fetch from £2 up to a quite exceptional maximum of £24. In the Mzab it would easily sell for £12 or £16, and the price might go up to £20, £30, and sometimes even £40. Now, a palm-tree worth on an average £10 or £12 would not produce more than eight shillingsworth of dates per year on an average. And the same proportion holds good to-day.

It should be noted that the only profitable palm-groves owned by the Mozabites are outside the Mzab, especially at Wargla.

On the other hand, these gardens of the Mzab present a magnificent display of plant life. They

are regular thickets, reminiscent of climates where the humid heat gives natural luxuriance to the vegetation. Between the slender trunks of the palms are planted huge fig-trees, their multiple trunks concealed by their spreading branches and foliage, while pomegranate-trees, apricot-trees, and peach-trees form a dense undergrowth beneath the palms, and enormous vines spread their branches in all directions, clinging like lianas to the palm-trunks. Into this tangle of overlapping leaves and boughs the sunlight can scarcely penetrate, and, whereas in other Saharan oases beans or barley are grown at the foot of the palms, here they are often relegated to the edge of the palm-grove—the forest border—making a fringe of brighter green around the gardens.

The general impression produced by the Mzab is a very complex one. Throughout the region one sees things that remind one of Egypt, and the first and main reason for this must undoubtedly be looked for in the steep slopes of dry rock in the Chebka valleys, whose colours, varying from gold to tawny and red according to the time of day, recall the long Libyan and Arabian cliffs and the bare, coloured slopes that border the Nile valley. Then, too, it often happens in the Mzab that cultivation comes to an abrupt end in a more sharply drawn line than in the other Saharan oases: little squares of green barley are like miniature oases entirely surrounded by rocks and sand, particularly at Berrian. Again, the continual creaking of the pulleys of the *hassis*, or wells, recalls the creaking of the Egyptian *sakieh*, and the wells of Beni Isguen, whose owners divide the time between them or sell it to others, and whose work never ceases by day or night, make one think inevitably of the *sakiehs* of Upper Egypt, owned in common by the Nubians, where each comes in turn, accompanied by his beast, to draw his water, so that the precious toil is never interrupted. Elsewhere, however, the crowded mixed gardens like those of Ghardaia and Metlili carry our minds very far from the flat and regular fields of cotton and sugar-cane on the banks of the Nile, and the only memories they can awaken are of the pleasure-gardens of Cairo and Alexandria.

The Mozabites, who are such clever builders, have at their disposal an admirable kind of mortar called *timchent*, made by baking a mixture of chestnut-brown limestone and earthy gypsum, called *kaddan*. It is a pinkish colour, and has the twofold advantage of drying very quickly and being exceedingly strong. It sets rapidly, like plaster, and has the qualities of cement, so the Mozabites are very well equipped in the matter of building. Living on rock, they certainly have plenty of stone, and above all they have this *timchent*. It should be remarked, however, that in this respect also the labour demanded of man in the geographical environment of the Mzab is far harder and more costly than in the Souf, for *timchent*, like lime, is a product obtained by baking, and in a country like the Mzab, where wood and other fuels are very scarce, the baking of the *kaddan* is a considerable task: they burn *drin* or *retem*, and have to go to some distance to gather these bunches of fuel. **But the Mozabites are accustomed to laborious and untiring effort, and their buildings are perfect.**

The Mozabites always build elaborate, two-storied houses. The ground floor gives on to an inner courtyard, or else the first-floor rooms open on to a terrace in the form of a court, and the openings are generally arcades of semicircular arches. These arcades are very popular: the market square of Ghardaia is surrounded by them. The arches are made by bending palm-stalks round, putting *timchent* on them, and then removing them, thus producing a rudimentary kind of arch. I was told by the *kaid* of Ghardaia that in former times the Mozabites did not even use palm-stalks, but built vaults and arcades without any recourse to curved branches.

The Mzab house is, on the whole, less original than that of the Souf, but the general appearance of the houses all together is incomparable, and a Mzab town has a physiognomy all its own. (See Figs. 114 and 115.) Despite their differences, there is a family likeness between the seven towns—or eight, if we include Metlili. This is owing not only to their numerous arcades or their crenellated walls of *timchent*, but also to the lofty minarets of their mosques, called *somars*, shaped like obelisks, and built likewise of *timchent*, their red colour being as characteristic as their shape.

Regarded as a place of habitation, the Mzab has, lastly, one curious feature: the Mozabite not only lives on the choice produce of his garden, but spends half his life *in* his garden. For besides

his house in one of the villages, each Mozabite has a house in his garden, where he lives with his family during the hottest months, often staying there more than half the year, from May to December 1, living mainly on the dates, vegetables, and fruit grown on the spot. So he has two houses, a town one and a country one, and whereas the town houses are closely grouped together the country ones are dispersed among the gardens, almost invisible beneath the palms and fruit-trees, but built in the same style as the town houses and, like them, very often having two stories.

Separate mention should be made of the curious settlement of Metlili, lying to the south of the Mzab oases and representing an intermediate or transitional stage like Hamich. There, too, the Chamba nomads have gardens just like those of the Mzab sedentaries and watered by wells of the same type. These nomads come and pitch their tents in their gardens near the summer dwellings, which are built in the same way as in the Mzab and scattered, like them, among the plantations. Too much attention cannot be given to such transitional types as Metlili, in the Mzab, and Hamich, in the Souf. When one feels and sees the deep gulf that parts the nomad from the sedentary in the Sahara one is brought to a halt by such complex facts as these. Is it the ascendancy of an exceptionally superior cultivation imposing itself even on those who despise cultivation? It would be rash to ascribe it to a single reason. **What is true is that human settlements in the desert present us with much more complex combinations than is commonly imagined, providing new and precise confirmation of what was said in Chapter IV about nomadism and semi-nomadism.**

The table below has been drawn up on exactly the same lines as the corresponding one for the Souf oases, but with figures for 1896.

Population	The Seven Towns of the Mzab	Camels	Sheep	Goats	Palm-trees
8,314	Ghardaia (*ksar*)	209	1,000	507	60,591
2,017	Melika (*ksar*)	32	522	381	4,032
5,205	Beni Isguen (*ksar*)	41	—	706	26,084
1,010	Bou Nourra (*ksar*)	14	—	164	9,600
2,346	El Ateuf (*ksar*)	10	—	1	14,479
3,322	Guerrara (*ksar*)	118	540	743	25,700
3,040	Berrian (*ksar*)	66	3,670	1,335	25,775
25,254	Totals	490	5,732	3,837	166,261
	Metlili Group				
1,425	Metlili (*ksar*)	268	830	1,450	7,851
2,210	Oulad Allouch (nomads)	1,815	15,615	9,417	8,183
2,160	Oulad Abdelhad (nomads)	1,814	14,499	3,421	11,065
5,795	Totals	3,897	30,944	14,288	27,099

It is easy to see how clearly this table shows the more nomadic character of the inhabitants of Metlili (including both the sedentaries of the *ksar* itself and the nomads), for, though numbering fewer than 6000, they had nearly 4000 camels, while the 25,000 inhabitants of the seven towns had only 500 between them. The people of Metlili, however, owned nearly as many palm-trees per head (27,000, or five per head of the population) as all the town-dwelling Mozabites (166,000, or more than six per head).

The Mozabite is wealthy and well fed: to be both rich and hard-working is an extraordinary phenomenon.

And now, in conclusion, we must inquire what kind of a man this Mozabite is—this strange person who leads a life so refined and complicated in surroundings so barren as to seem at first sight to render impossible all cultivation and even the most rudimentary kind of human life.

The Mozabite is to an increasing extent an abnormal phenomenon. He can no longer be explained by the Mzab alone. No doubt the Mozabite of bygone days, though only a cultivator, lived a simpler and less costly life, but the Mozabite of to-day cannot be understood without reference to the Tell. He is a cultivator in childhood and late in life, but throughout his adult life he engages in trade. He is born in the Mzab, and he dies there; he even returns there regularly; but he spends the greater part of his life far from his own land. He emigrates to the Tell to make a living, and he often gets rich there.

The Mozabites are not quite *all* emigrants, nor do they quite *all* become traders, but not to emigrate is to lose caste. The *kaids* of the *ksars* are former emigrants and traders who have become rich.

In the Tell the Mozabite is a merchant—a shopkeeper dealing in small wares, a grocer, coal-merchant, or butcher. He is easily recognized in the little shops of Oran and Algiers by his round and flattened face, as well as by his *gandoura*, or blouse, striped with great bands of colour. It is the money he makes elsewhere that enables him to keep up the costly cultivation of the Mzab. These cultivators can continue to cultivate their oases just because they *are* traders. Theirs is a strangely complex and mixed 'way of life.'

4. Conclusions

The Souf and the Mzab

Our object has been to lay stress on what is abnormal in these facts of human geography—such facts as our utilitarian civilization can no longer produce. As a phenomenon of human and social geography the Souf is from every point of view an exceptionally strange case. Property there does not consist of land, for of those vast spaces covered with sand or sandhills every one can take what he requires to plant a few palm-trees or build his house. Neither does property consist of water, for water extends beneath the sand in relatively wide layers, within reach of anyone with enough perseverance to remove twenty-five or thirty feet of sand to get near it, so as to plant trees or dig wells that reach down to it. The only thing that is capable of being appropriated is the tree, or, more accurately, the date-palm. Each man owns what he plants, and his ownership of the tree carries with it the use of the land. Conversely, whoever has no tree has no land and cannot dig wells, for since there is no valid reason why he should have any right to land or water he owns neither the one nor the other. He will own land and water only if he wishes himself to plant trees and digs and clears a place for a garden. In other words, land and water belong to all, and it is only work, actually carried out and continued, that determines and limits their private appropriation. Geographical conditions are so peculiar that the tree is the primary cause, the limit, and the end of all individual appropriation.

The 'islands' of the Souf and the Mzab are human settlements situated in regions clearly marked out by nature to be uninhabited areas, or, at all events, areas from which cultivators are excluded. In both cases Nature strongly disputes with man the area that he cultivates. In some parts the wind that piles up the sand is a perpetual menace, and in others there is the constant fear that the water-supply may fail. The gardens of the Souf are protected against sand and wind by being dispersed and scattered, and when water fails in the Mzab, as, for instance, around Ghardaia, cultivation assumes a similarly sporadic character.

The whole of the recent history of irrigation in Ghardaia turns on a fact that shows most clearly

the inconvenience and ruin that may be brought about by the absence of any general organization. Since 1867 the little oasis of Daiet ben Dawa has been permitted to be settled, a few miles above the oasis of Ghardaia, and to-day it is fully developed at Ghardaia's expense, for it uses up the water that formerly supplied the gardens lower down. So cultivation is becoming more and more scattered.

In the Souf, as well as in the Mzab, the difficulties are so great that the people of these two oases seek resources even outside them. These two racial and geographical groups live more and more on the Tell. The sedentaries have become, not desert nomads, but nomads of a particular kind—namely, emigrants. Being masters of the art of cultivation and driven into trade by necessity, they are increasingly a hybrid type of cultivators and traders combined.

Although the Mzab and the Souf have been thought to merit a comparative study from the point of view of human geography, we have shown how unlike they are from the point of view of agricultural geography and in general appearance. In the Souf the trees stand alone, with nothing at their feet. There is no cultivation, no canals, not even any small ditches, and the ground is flat. In the Mzab, on the other hand, the soil is worked, turned over, and laid out, and below the palms are dense groves of various kinds of trees. Nowhere in the Sahara does the palm grow in greater isolation than in the Souf, and nowhere is it more mixed with other trees than in the Mzab.

From this collection of comparative observations there emerge some general conclusions.

The Beni Mzab and the Soafas were enabled to settle in their oases in the Chebka and the Souf only by introducing cultivation of the most improved kind. Perfection was forced upon them with inexorable rigour by geographical conditions. Mediocre cultivation was impossible, and men had to acquire a taste for the most exacting and methodical toil if they were to remain in such places as these. These are not human settlements that have value only because of the efforts made and the *relative* standard of production and well-being obtained in spite of natural conditions. They are settlements that have value because of their *absolute* perfection. They represent the best that can be imagined and practised in oasis cultivation: it is as if we found the market-garden cultivation of Nantes or a Paris suburb in an Alpine valley three thousand feet up!

They are not like extreme outposts of humanity situated at the geographical limit where human life becomes impossible—rudimentary and, so to speak, borderland forms of human settlement, like the groups of Eskimo huts. They are settlements perfect and complete, situated in natural 'islands' where life is possible but hard, where the inhabitants are fairly numerous, but where the organization of labour reaches in general a much lower standard of perfection or goes with quite different forms of social organization, as, for example, the nomadic life of pastoral peoples living tribally in tents. When we speak of the Soafas, and even more when we speak of the Mozabites, we are not speaking of primitive peoples providing for their essential needs by elementary methods, but rather of types of an advanced civilization.

This type of perfection in exploiting Nature in unfavourable conditions might perhaps be compared with the skilful and successful use that the Finlanders have made of their very unpromising country, where they have managed to transform a land that is snow-covered for seven or eight months of the year into one that is not only self-sufficing, but is developing more and more exports—of butter, for instance.

This perfect type of cultivation in limited areas reclaimed from the desert merits comparison still more directly, from the point of view of human activity, with the equally perfect and intensive cultivation of areas laboriously reclaimed from the sea, called *polders*.

In this case man's toil, winning back from the salt water of lagoons or the sea the soil from which it can be fed, shows such unremitting effort and an energy so methodically employed that the cultivation that benefits from these conquests is naturally methodical and perfect too.

The real interest, indeed, in studying these two groups in the Souf and the Mzab lies in bringing into clear relief the perfection of cultivation in conditions so difficult that any mediocre methods, easy-going and indolent, could never have taken root there. The geographical point that should here take precedence of all others is this: *it is conditions unfavourable in themselves that cause the perfection of these human settlements*. The effort made by man to exploit the soil is a factor alike of what he wants to do and of the difficulties imposed on him by the earth. And the more difficult and refractory the earth the more this effort increases in energy, skill, and ingenuity. Under the direct influence and pressure of these imperious necessities man sometimes succeeds in attaining a rare degree of perfection.

Chapter VII

SPECIAL STUDIES IN HUMAN GEOGRAPHY

SECOND EXAMPLE: AN UNUSUAL 'ISLAND' IN THE ALPS (THE VAL D'ANNIVIERS)

1. The Val d'Anniviers and Human Migrations

In the upper valley of the Rhône, which is a wide, flat *thalweg* enclosed by two high walls often inclined at an angle of nearly 40°, right above Sierre and to the south of it, the slope of the left bank is cut by a very clear and visible notch that marks the upper widening of a deep and almost indiscernible couloir only a few score feet wide. That is how there appears on the horizon the outlet of one of the river's little tributaries, the Navigenze, and also of one of the elongated valleys on the left flank of the Rhône. These valleys run in a general south-to-north direction, and they are all independent and separate 'countries,' generally bearing the characteristic name of 'Val.' We are concerned here with one of the most typical in the whole of Valais—the Val d'Anniviers. (See Fig. 108 and Map XXXI.)

The Val d'Anniviers extends from the massif of Mont Collon and the Dent Blanche to the Rhône, a distance of some twelve miles, and, as often happens in these 'Vals,' the narrow and steep-sided couloir shows a general tendency to widen and spread out as it goes upward. Moreover, this almost rectilinear valley forks in the middle into two smaller valleys also called 'Vals'—the Val de Zinal and the Val de Moiry—so that the whole Val d'Anniviers has the exact appearance on the map of an inverted Y (⅄), with its foot on the Rhône to the north and the two branches in the south where the streams rise. The part that is widest and best suited to human settlement is not the part nearest the Rhône, for the Navigenze valley, formerly occupied by a glacier, a tributary of the great Rhône glacier, ends in a 'confluence step' and the rushing stream has crossed this step by cutting in it a very narrow and inaccessible gorge.

The upper valley comes to a dead end, so narrow that it may be regarded as closed at the lower end, at what is called the Pontis gorge, and it is above this gorge that the most inaccessible part begins. From there to the point of bifurcation of the inverted Y there extends the principal zone of settlement, the zone of concentration and movement, the real centre of the Val, and the part which indeed expresses and maintains its individuality.

At whatever time of year you enter Anniviers you meet families going up or down with their flocks and household goods as if they were leaving the place for good. And at the same time you cannot fail to be struck by the incredible number of dwellings and roofs to be seen, giving the impression of a large population. But on getting nearer you notice that whatever the season many of these houses, and many even of the villages, are absolutely empty. These families on the move are not leaving the district, not emigrating in the strict sense. This is just one of those periodical migrations that are customary among the Anniviards—a form of true nomadism.

These periodic migrations are, to the best of our belief, the most complete type of pastoral nomadism that exists in the Alps. For while in most other valleys pastoral nomadism consists merely in driving the beasts alternately from valley to mountain and from mountain to valley, involving only a double journey and a double halt, and while very often there is simply transhumance without nomadism (see Chapter IV, § 7), in this case all the intermediate stages

have been retained as indispensable halting-places on a more complex journey. But that is not all. Instead of the longest stay being made, as in other valleys, in the winter village, part of the family remaining always in this village even in summer, so that it becomes a kind of permanent habitation,

Map XXXI

The Val d'Anniviers (Valais) and the Outlet of the Navigenze in the Rhône Valley

here in Anniviers the inhabitants spend scarcely any more time at one halting-place than at the others, and all these various 'stations' are at one time or another completely empty.

This system results from the physical environment because, in the first place, it depends on well-planned utilization of the soil. If the people were content just to mow the meadows between the village and the alp without putting back in the form of manure what they have taken out as hay, then the soil would soon be exhausted. One way of making this restitution would be to carry the manure on the backs of mules, as is done sometimes in the French Alps. But, without entirely

neglecting this method, the Anniviards prefer a different one. That is to keep cows everywhere in the valley, so that the whole of it gets manured. So there is a supplementary stage, intermediate between the village and the alp, called the *mayen*, or 'fore-alp.'

But there is another reason that has compelled the Anniviards to make every part of the valley as productive as possible—the growth of the population. There were 2238 inhabitants in 1900 and 2831 in 1910, compared with 1975 in 1870 (though the population fell to 1861 in 1930). So for the time being Anniviers was over-populated in relation to its area. But the Anniviards did not emigrate, and what enabled them to maintain this population—secluded alike by nature and by their own desire—was their primitive customs and old-fashioned manner of life. For as the population grew till it could no longer live on the same area of fields and meadows the people went off to the Rhône valley in search of more land. **This descent into the valley meant a fourth set of 'stations' in addition to the three kinds of mountain ones.**

Though all the valley possesses meadows and pastures, there are some villages, like Chandolin, that are almost entirely without cultivated fields, and their inhabitants have had to ask for an extra supply of corn from areas lower down, such as Sussillon and Le Réchy, and even the valley of the Rhône. Wine too became a temptation long ago: as early as the thirteenth century we find Anniviards owning vines at Sierre, and little by little the mountain-dwellers, more hard-working and thrifty, acquired a considerable part of the vineyards of Sierre.

Such are the general facts that explain the multiplicity of the yearly 'stations' of the Anniviards, **each of which, except the alp, is marked by a permanent settlement, while even on the alp itself there are durable buildings.**

2. The Villages

What exactly is a village? It is a term applied to a geographical fact—the collection of houses and residents of the most numerous aggregations. But the 'village' as a collection of residents goes along with, and is strongly contrasted with, two older groupings—the political group called a 'commune' and the ecclesiastical one called a 'parish.' Village, parish, and commune are three distinct units.

This complication of terms and tangle of areas, recalling the French *ancien régime*, is a relic of a very ancient state of affairs in which jurisdictions of different origins were superimposed one upon another without the first one being abolished. Their history can be reconstituted as follows. The occupation of the valley began at Vissoye, where the ruins of the castle recall the presence of the *vidame*, who administered the valley on behalf of the Bishops of Sion, for the latter were the owners of the valley ever since they had converted to Christianity those of the inhabitants who were still heathen. For a long time Vissoye, the mother parish of the valley, remained the only parish, and it was at her expense that other parishes were eventually formed around churches built originally for the convenience of the inhabitants. When the system of communes came to be superimposed on that of the parishes Vissoye remained undivided. That is the explanation of the strange fact that Vissoye appears on maps as the centre of Anniviers and yet did not figure in the census returns until 1910.

The site is well-chosen. It is the middle of the valley, between the fork and the barrier, that is best suited to human settlement, and there, too, grouped in a small space, are villages and hamlets, dwellings and farmhouses, so close together that they seem almost joined along the old cart-road. It will be seen that all these contiguous groups in the middle part of the valley stand together in a rectangle no more than three miles long by a mile wide, rising in tiers between 4000 feet (Vissoye) and 5000 feet (Ayer). If we bear in mind that each family owns at least three adjoining buildings, or 'roofs,' in each 'station' where it stays, and that one family is mentioned at Grimenz that owns seventy of the 'roofs,' dispersed through the valley, it is easy to realize the aggregation represented by each village, which therefore seems far more important than it actually is.

Let us enter the village. In each of these temporary 'stations' the Anniviard owns a dwelling-house, a barn and stable, and a storehouse and still-room. **The dominant type, as in all the lateral valleys of Valais, is still the wooden house with galleries, on a stone foundation.** The roof is of deal planks, often kept in place by large stones. The search for a favourable aspect means that the house does not always face the road, and it generally has no windows on the shady side. Thus the pursuit of the sun is apparent even in the arrangement of the house. The nature of the materials used is explained by the abundance of wood, but on account of the danger of fire the wooden house is everywhere giving way to the stone one, and we can foresee a time when it will remain nothing but a memory.

The barn is a wooden one, built of deal scantlings joined at the four corners, containing the stable beneath and the barn, in the strict sense, above, with the hay. The actual granary where the sheaves are stored is the *racart*—that building perched up on piles that is to be seen all over the canton of Valais, with its round stones laid flat to prevent the entry of rodent animals. Inside is the threshing-floor, and here are stacked the sheaves waiting to be threshed when bad weather gives enough leisure. In the other storehouse are kept the winter provisions of bread, wine, and cheese, and here, too, the meat is dried. Its place is often taken by the large living-room. In the cellar beneath the storehouse is kept for years and years the famous 'glacier wine,' made from grapes harvested on the hillsides of Sierre, which improves every winter.

It is now possible to understand the great number of dwellings and roofs that go to form a village, since a single family inhabits several villages at once and occupies several 'roofs' in each village. The Anniviard builds his house in the traditional style, without making any innovations, and this explains the persistence of the 'multiple house,' with as many roofs as there are groups of objects, whether human beings or animals, to be accommodated.

3. The *Mayens*

What exactly is a *mayen*? It is the pasturage of the month of May—the spring grazing-ground to which the cows are taken on leaving the cowshed until the alp is free from snow, which does not happen till June. In autumn, when the alp is again snow-covered, the herd makes a second stay at the *mayen* on its downward journey back to the village. So it is the pasture of the intermediate seasons, generally half-way between the village and the alp. In Anniviers, therefore, as throughout Valais, we find in the 5000–6500 foot zone a zone of *mayens* above the village zone which lies between 4000 and 5000 feet. It happens, however, in some cases, to be explained later, that the village lies higher than the *mayen*, and this occurs more than once in the Val d'Anniviers. Thus Saint-Luc (5300 feet) has its *mayens* at Barmaz (2900 feet) and Niouc (2800 feet). Chandolin, at 6300 feet, has several groups of *mayens* at different levels below it—at Réchy (5400 feet) and Sussillon (4500 feet).

In the *mayen* there are only house, barn, and cellar, instead of the high-perched *racarts* alternating with houses and barns as in the villages. Sometimes, as at Grimenz, the *mayens* are so near the village that the inhabitants go up to them every morning. And once again we note an actual transformation, Zinal, a centre of *mayens*, having become a town with hotels, and now a church as well.

The existence of a spring and autumn pasturage between the village and the alp is due to physical conditions, and results from the peculiar climate of Valais and its lateral valleys, which are drier, warmer, and more forward than the majority of Alpine valleys. Everything in the valley—the height of the villages, the nature of the crops, and the kinds of trees in the forest—bears witness to this climatic influence and the consequent rise in all altitude limits. Thus we find cereals grown up to 6000 feet, forests up to 6500 feet, and trees up to 7000 feet; 9000 feet is the limit of the alp, and the hut on the Lona alp is at 8600 feet. There are no strong winds, either in winter or summer, and no one knows better than the Anniviard how to take advantage of the situation on a less pronounced slope (owing to the north-and-south trend of the valley) than the parts with a better aspect alternately to right and left of the stream.

4. The Alp

The second station, and the highest above the village, is the alp, and its exploitation is the reason for the existence of the villages in the valley, their means of livelihood, and the origin of the occupation of the valley. Owing to physical conditions in the valley, the sojourn in the alp—what the French call *inalpage*, or 'enalpment'—begins earlier and ends later than in other Alpine regions, besides being possible at a greater height. If we reckon alp and *mayen* together—for the latter is only a detached portion of the former—the melting of the snow in May instead of June, as in the rest of the Alps, has made it possible to add several weeks to the hundred days of 'enalpment,' in the strict sense, so that the flocks remain out of the villages for six months.

To whom do these high pastures belong? Is it the commune, as in part of the French Alps, where the common land is all too quickly recognizable by its worn-out and devastated appearance? Or do they belong to individuals, as in other parts, where this system of ownership sometimes represents an encroachment on general rights? The answer is that they belong to neither, for we find in Anniviers a method of exploiting the alp by groups or partnerships of owners. This, which seems to have been the primitive system, combines the advantages of private and communal ownership. Out of twenty-one alps two belong to individuals, one to the commune of Saint-Luc, and the remaining eighteen to associations, of which the Zinal Company is the best example.

These high pastures feed many head of cattle: in 1906 the number was 2100, almost the same as the number of human inhabitants.

The buildings erected on the alp are primitive compared with those in the valley, the most essential one being for cheese-making, called a 'cellar' because it is used for storing butter and cheese. The *Sennhütte*, or herdsman's cottage, is generally built entirely of stone, because wood is lacking, and these dry stone huts are met with at heights unknown elsewhere, in accordance with the higher limit of the alp pasturage. Several of them are 8400 feet up, and the Lona hut, at 8600 feet, is reckoned the highest in the whole of the Alps.

No one lives on the alp but those who are indispensable for looking after the flocks and herds (which include not only the milking cows, but bulls, heifers, and sheep as well), and for milking and making the butter and cheese. When the summering is over the season's produce is divided in proportion to the amount of milk produced by each owner's cows.

5. Anniviard Villages in the Rhône Valley

The descent of the Anniviards into the Rhône valley is another example of the irresistible attraction exercised over mountain-dwelling people by vine-growing lands. The former were in the habit of taking their cattle with them when they began to stay longer in the plain, and so they had to add meadows to their fields and vineyards. Then in the midst of these agricultural undertakings which had hitherto sufficed there arose actual villages on the sites of the earlier temporary dwellings, at first only slightly constructed, but later built to last. On travelling round the outskirts of Sierre one cannot fail to be struck by the unusual number of villages forming a double semicircle of houses on the lowest slopes around that town: Muraz, Villa, Borsuat, la Zarvettaz, and Glarey—five villages in quite a small space. These aggregations are almost suburbs, and therefore not true villages. Rather are they just stations marking the extreme limits of the journeys of the Anniviards, where they stay three times a year, their principal stay being in March, to consume the winter hay and prune the vines. The entire able-bodied population moves in a body, to the number of at least 1500 persons, headed by the parish priest and including the magistrate and the president. So while the villages of the plain are fully populated, the mountain ones are deserted by all except those left 'on guard.'

The Anniviards are not scattered around Sierre in a haphazard manner, but grouped according to their villages, especially the upper ones, Saint-Luc and Chandolin, which are always rather apart from the other communes. Thus to each mountain-dwelling group there corresponds a well-marked group in the plain.

There is hardly any difference in external appearance between the villages of nomads and those of the sedentary husbandmen or vine-growers of the valley. This state of affairs marks the end of a long evolutionary process, for as agricultural occupations became added to the original vine-growing these temporary shelters became surrounded by outbuildings, and so as they grew they took on the appearance of villages.

6. Conclusions

Sun, Irrigation, Nomadism

If we wanted to sum up in a single phrase the general economic principle underlying all human settlement in the Val d'Anniviers it would be the pursuit of the sun—warmth and light. Given a valley running north and south and very closely shut in, the question is how to arrange the houses and the cultivation so as to get enough warmth and light. At first, advantage was taken of the more open parts of the bottom of the valley, corresponding to the terraces of the ancient glacial 'trough.' Later on the lateral grooves made by the glaciers and tributary streams were made use of. Thus Saint-Luc was established at a height of 5200 feet, facing south, and Chandolin in a similar position at a height of nearly 6500 feet. On the steep sides of the left bank of the Navigenze a large hamlet managed to be formed right on the slope itself. It was built on one of the sharp edges of the crumbling moraine, and on these frail ridges it stood, advancing as far as it could so as to get the sunlight. Even in the evening, when the shadow of the hillside reaches down into the valley and gradually covers the whole of it, Painsec is in much longer enjoyment of the sun's last rays.

But what is better still is that this pursuit of the sun just noted, first in connexion with the orientation given to each house and then in connexion with the siting of all the aggregations, is to be noted yet again in regard to the position and distribution of all the fields and gardens. Prince Roland Bonaparte, giving some very interesting facts to show "the influence of aspect on the situation of the Valais villages,"[1] spoke also of the orientation in full sunlight of certain fields lying at a very great height, including, of course, those of Findelen, near Zermatt, which extend up to nearly 7000 feet. This aspect of the fields, facing the sun, is the dominant feature in the Val d'Anniviers at all altitudes.

Having such natural advantages, the Anniviard has found means to increase the productiveness of the alp pastures even more by his own efforts. These, like the vineyards of Sierre and the meadows and *mayens* of the valley, are irrigated. Irrigation is more needed here than elsewhere because of the greater amount of sunshine and the drought arising from continued fine weather. The irrigation channels, called *bisses*, get their water from the little mountain lakes or the streams that issue from the glacier. (See Fig. 6.) And so yet another kind of grouping—for irrigation—is superimposed upon the village, the commune, the parish, and the independent organization of the alp. Each *bisse* has its own head man, elected by all who share the water, as well as its own council and its written regulations concerning the distribution of the water and the hours and days it is to be used by each participant.

So while overflowing from the only part of the valley that is not closely barred and settling in this intermittent manner near Sierre, the people of Anniviers, however much their numbers have increased, have remained firmly established in their 'island,' the Val. And thus they have been led to make more and more skilful use of sun and water, their two sources of wealth. What remains is quite clearly nomadism. It would be an undue simplification of their manner of life to regard it as determined by the seasons—winter in the village, spring on the *mayen*, summer on the alp, and autumn in the Rhône valley. The inhabitants of the various aggregations must be followed step by step if we are fully to understand their journeyings.

[1] *La Géographie*, vol. xi, 1905, pp. 212–216.

"As soon as they learn, at the beginning of March, that the Sierre vineyards are free from snow and that the ground is thawed they go down in detachments, one family after another. All through Lent they are busy with the vines, and in Easter week the whole procession returns to the chief town in the valley. Meanwhile the snows have melted and the sowing is done—potatoes, barley, and hemp. When this is finished they go up, family by family, to the *mayens*, to use up the supplies of hay. Thus, little by little, summer comes along. The rye or wheat sown on the upper slopes of the Rhône valley has long been ripe, and the meadows are ready for the scythe. This time the cows remain on the *mayens* or begin the ascent to the alp, and at the end of September they return to the

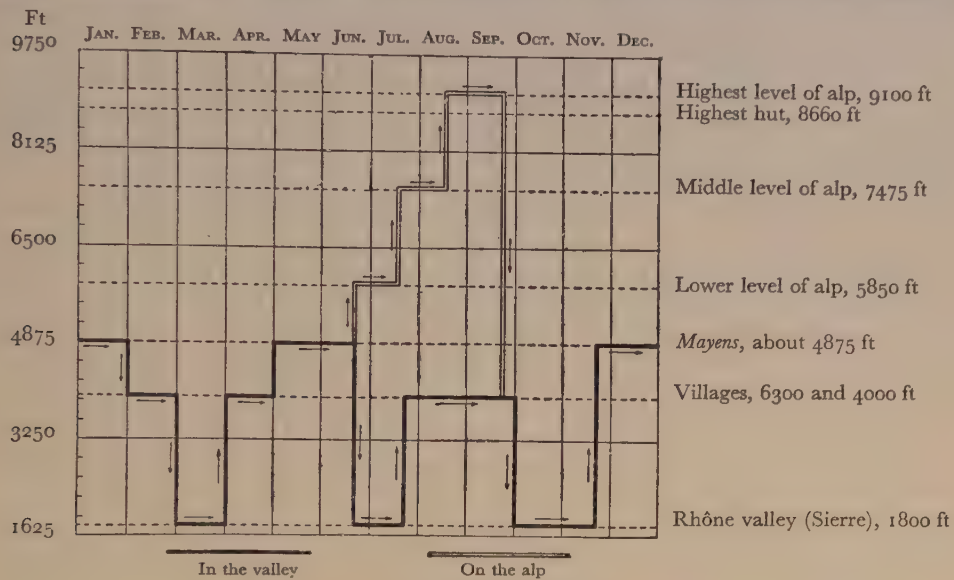


Diagram XXXII

Showing the Migrations of the Anniviards, Month by Month

After Wolf and Schroeter

neighbourhood of the villages. During this time the hay and other agricultural products have been stored in the barns and the rye has been sown around the villages.

"In the Rhône valley the grapes have ripened, and for the third time the Anniviard goes down for the grape-harvest, which is not accompanied by any rejoicings. Gradually the cows come down from the heights, and once again the whole population is reunited until St Catharine's Day (November 25), the date of the Sierre fair, after which the people return with the cattle to the *mayens* to take up their winter quarters. . . . In the week before Candlemas (February 2) they begin to go down again, and their arrival soon announces to the inhabitants of the Rhône valley the return of spring."[1]

Throughout the year at each season, each month, and almost each day the Anniviard journeys up and down unendingly on his long and toilsome road throughout the length of this valley, where only one thing is owned in common and not divided into four—the cemetery at Vissoye. Owing to this regular organization of his life he is at a higher altitude on January 1 than in November, and higher in February than in October or March.

[1] H. Girard, *Geologische Wanderungen*, vol. i: *Valais, Vivarais, Velay* (Halle, 1855), pp. 51–90.

These winter migrations are the exact converse of the normal summer ones, when in almost all pastoral mountain areas in Europe the herdsmen and their herds go up on to the heights from May to September, and the warmer it is the higher they go. (See Diagram XXXII.)

The simple movable tent is made impracticable by the height and the climate, and so, too, is the hut that can be rebuilt, and the Anniviards have solved the problem by creating real villages like those of sedentary peoples, and living in them and deserting them alternately. In this way they are enabled to lead a nomadic life.

Whereas the ordinary nomadism of the mountainous parts of Central Europe is a warm-weather one, or, more precisely, a nomadism of the yearly period of vegetable activity, the Anniviards have found means, in the very heart of the Alps, to be nomads even in winter. And the various kinds of human aggregations scattered through the Val d'Anniviers are at the same time the material imprint and the geographical expression of this complex and uninterrupted nomadism.

Chapter VIII

FACTS OUTSIDE THE 'ESSENTIAL' GROUP:

REGIONAL GEOGRAPHY AND ETHNOGRAPHY; SOCIAL GEOGRAPHY; GEOGRAPHY OF HISTORY

1. Human Geography and Regional Geography

Other Human 'Islands'—Sea Islands—Countries and Natural Regions

The special study of the real connexions between the 'essential facts' on the lines of the preceding studies, might well be extended to many other settings, among which the islands or islets of humanity will always provide specially favourable places for observations. Sea islands and peninsulas were, until our own day, the only kind that really aroused the curiosity and held the attention of genuine observers. Islands, indeed, may even be held to have given rise to the first real studies deserving to be called regional studies, because their boundaries are so clearly marked off by the sea. Nothing could better show the true bonds uniting the method expounded here and the general method of regional geography than to conclude with a synthetic and co-ordinated collection of notes on a group of sea islands, chosen from that most human of all seas, the Mediterranean.

The Two Principal Balearic Islands, showing how the Geography of Islands is truly Regional Geography

The principal island of the Balearic group, called Mallorca or Majorca, is bordered and outlined, as it were, by a great rocky Sierra in the west, faced on the east by a region having the same general aspect, but of much gentler relief—a zone of overlapping strata sprinkled with discontinuous groups of hills. Between these two roughly parallel hilly areas there lies in the centre of the island a plain shaped like the bottom of a boat, very open, and plentifully furnished with rich soil formed by erosion and filling in. All the most flourishing and crowded life, all the rich and populous towns, the oldest roads and all the railways so far built, are on the flat and fertile soil of this vast central furrow, or at least on either side of it, on the first of those moderate heights at the edge of it which are rather appendages than boundaries. Thus the little towns of Inca and la Puebla, Alaro and Petra, Manacor and Felanix, are all in the centre of the island.

Olive-oil, figs, and almonds are produced in great abundance, and all are exported, especially the almonds. These are the 'upper-storey' crops, hanging a few feet above the ground, but we must take into account also the curious undergrowth of ordinary food crops—cereals, vegetables, pimento, potatoes, or beans, often yielding two harvests a year. One harvest above and two below: that is what the precious soil produces in those square or oblong fields marked out by a chessboard pattern of walls. But this is at the cost of unceasing and repeated toil. The branches of the trees are heavy, as it were, with the labours of these highly skilled tree-growers, and the soil beneath their feet, turned over by spade and plough, reveals everywhere the unfailing efforts of men's muscles: the Majorcans are beyond all else pertinacious and praiseworthy workers.

With the exception of the outskirts of Palma, the countryside is devoid of houses, though here and there are a few small *casas de guardia*, which are simply the equivalents of the *bastidons* and *capites* where in other lands the tools and baskets for the harvest or the grape-picking are put away for the night.

In such small or medium-sized islands as the Balearics, and particularly outside the bounds of

large towns like Palma, the capital of Majorca, there are still to be found the distinctive characteristics of the most ancient Mediterranean life. The Mediterranean peoples being first and foremost city folk, or, more correctly, town-dwellers, they are almost all congregated in groups of adjoining houses—so closely joined, indeed, that the whole aggregation looks like a small town even when it is merely a village. **One of the general and inevitable results of this concentration is that the inhabitants live far from most of the fields which they have to dig and sow, and have therefore to travel to them every day.** These double journeys, morning and evening, as regular as the ebb and flow of the tides, are mass migrations, though very short ones. I remember leaving the little town of Pollenza one evening to go to Alcudia. The sun had just set, and for five or six hours I followed a bad but pleasant sunken road between the olive-trees. I counted the carts returning in a regular procession from the fields, and I met ninety-seven of them. They carried some delightful loads: in one there were seven children crowded round Mother, with Father in front holding the three leather reins; in another were two women in mourning, no doubt a mother and sister, with three little black-eyed girls; and in a third cart were two old people, a man and a woman, close together on the seat beside the youthful driver. So once again each entire household was returning home after the day's work. The Mediterranean husbandman is always on the move, and he must and can organize unceasingly his repeated journeys. Whoever drives the plough in the Balearics must needs be a traveller.

The fishermen of Majorca are in general quite separate from the cultivators, but the latter need the fishermen's boats to transport their produce. The island life is becoming less and less self-sufficient.

Again with the exception of Palma, which, with its 90,000 inhabitants, remains for its size the huge, abnormal, and unique urban geographical feature of the biggest Balearic island, the towns and ports are separate, but each town in the coastal belt has its own little port. This is not a mere dependency or appendage, however, for the groups of inhabitants who own boats and make a living from the sea show their independence by the long distances that separate them from the towns. Thus Soller has its port on a very pretty roadstead a couple of miles away and entirely outside the cultivated area. Pollenza, which belongs both to the Sierra zone and to the north coast, is some four miles from its port, and Alcudia over a mile. It is particularly in the hilly eastern region that the desire of the towns to share the economic and cultural life of the central plain has led to their being situated far from the sea, with the result that Puerto Colon, the port of Felanix, is nearly six miles from that town, and Manacor has its port at a distance of nearly eight miles.

The workers by sea and land, however, though separate, yet render services to each other and are, at bottom, closely associated. They could not do without each other, being two parts of a single whole whose 'ways of life' are complementary and make up together a general kind of regional economy. They have been bound to influence each other strongly, and many of the characteristics and aptitudes of the landsmen owe what might be called their breadth or scope to this contact with the men of the sea.

The fishermen of Majorca, besides fishing for lobsters and tunny, are to an equal extent coastal carriers—another of those fundamental survivals of Mediterranean life. Soller, a port of the Western Sierra, is very typical of these **twin aggregations**: an admirably cultivated oasis, sheltered by and almost hidden in the middle and at the foot of the dry and stony moorlands of the lofty slopes, and an almost perfectly circular cove with a single opening to the sea—the ideal port, placed in a sheltered situation on a coastline made dangerous by reefs. The great Sierra is thus 'peopled,' as it were, at different heights by skilfully irrigated oases. Suddenly there appear the marks of man's handiwork on the dappled flanks of the mountain, in the shape of walls placed one above another, remarkably built and finished (see Fig. 7) and supporting the olive-trees. For miles before reaching any inhabited place we can recognize the hidden presence of human hands, for these walls are kept in repair, the branches of the trees are pruned, and the soil at their feet has been newly dug. In order to preserve the precious humus and the water of the too infrequent showers, a series of small retaining walls, resembling the kind of stairway built in the French Alps to mitigate the torrential flow of a stream, has been planned with equal toil and ingenuity to cut the slopes of the

shallowest valleys. And all this without a man in sight, for the inhabitants are few and manage to distribute their labour over enormous areas.

Dry farming has now returned to us from America with all the glory of a success both scientific and practical. But for ages the husbandman of the Mediterranean world has grown olives, wheat, and grapes by this method. For at least twenty-five centuries he has known how marvellously the scanty supplies of water in the depths of the earth and the unreliable rainwater can be safeguarded by repeated dressings and continual loosening of the soil. Here in Majorca, where almost all the cultivable soil is utilized, one gets the actual impression from time to time of traversing vast solitudes, silent and deserted, cultivated by beneficent but unseen spirits.

The island of Minorca, lying to the north-east of Majorca, bears no resemblance to it. It is a huge tableland of stone, broken and battered, as it were, in the middle by irregular heights ranging from 600 to 1000 feet. Round a large part of its circumference this ends abruptly at the sea in steep cliffs from 60 to 120 feet in height. Thus the rim of this plateau overlooks the waves without any gentle slopes to make easy contact between land and sea. Fortunately the sea has invaded the mouths of a few of the streams and stayed there in these elongated harbours, for man's safety and even for his salvation in times of stormy weather. The ports of Mahon and Ciudadela are indeed curious—long and winding narrow channels where it seems as if the sea must be flowing between banks, though actually it is at home and remains there. After the gulf that winds inland without change of level the open valley continues. Since the sea has, as it were, corked up the bottleneck, the stream scarcely flows any longer, but the wide valley already hollowed out by the river in the limestone plateau remains, together with its alluvium and subsoil impregnated with water that can be drawn up by the 'noria.' **This lower zone, rich and sheltered, has become the zone of gardens,** the *huerta* of Mahon. It is the 'school of instruction' of the patient and expert horticulturists of that area, who have carried with them to Algeria, especially to Sidi Ben Abbes and other parts of the province of Oran, the benefits of their persistent experiments in cultivation.

All that remains to-day of the ancient valley, formed in bygone ages by the violence of the waters, is a chessboard of shrubs and vegetables, sprinkled with little white houses, ending only at the artificial wall where the harbour begins, dotted with white sails. And then comes a long, narrow gulf called a *cala*: **Mahon is just a gulf and a garden.**

The acreage of the garden is not large, and it cannot feed a population of 18,000, so fields and gardens have had to be created on the top of the plateau as well, where the rock is everywhere cropping out. Stone by stone the entire surface has been cleared, not only in the immediate outskirts of Mahon, but, we might almost say, throughout the whole island. These stones have been piled up into innumerable walls from three to six feet in height, which serve at the same time to get rid of the stones and for protection against the wind, especially the north wind, which blows frequently and strongly (see Fig. 12) with a cold blast that is deadly to plants.

"There is not much land, but what there is is good," say the Minorcan peasants. It is their main source of wealth, for it makes the wheat and oats, the vines and the fig-trees, grow, and it is tended with jealous and loving care. In the outskirts of Mahon I have seen men with little curved spades cleaning all the roughnesses of the stone as one might clean precious fossils, and collecting, bit by bit, even with their hands, the crumbs of the feast.

At the other end of the island, in the neighbourhood of Ciudadela, the limestone plateau is still more stony. Yet always between the great grey walls, and even among the broad slabs and projecting ridges of rock, the wheat is sown and grows up fine and tall. Elsewhere, in the lonely desert, can be found equally paradoxical examples of fruitful cultivation on dry and poor soil—a marvel that can be explained only by the employment of the ancient Mediterranean procedure of *dry farming*. All the central part of Minorca, more hilly and irregular, is also more favoured.

Mahon, the present capital, and Ciudadela, the former one, are quite unlike so many small towns in Majorca. From the top of sixty-foot cliffs overlooking the gulfs that penetrate inland they were suitable for defence posts, even quite close to the sea. They are built with the houses closely packed together and quite close above the natural harbours that they overlook. They are the real

and only towns of Minorca, one with nearly 18,000 inhabitants and the other with 10,000. Together they account for two-thirds of the whole population of the island, and by their situation and character they monopolize all its life. The men who dwelt on this soil, where the rock is level with the surface, or, rather, pierces through it everywhere, have managed to live only by removing and replacing the stones. No doubt from the very beginning they have built these walls of dry unmortared stones that defy alike the rainstorms and the years. But they have also piled up these stones in the same way to make shelters and monuments.

The megalithic monuments called *talayots* have been singled out for study by Carthailac. (See Fig. 27.) It gives real joy to geographers to find prehistoric customs still in existence, and in certain parts of the island, on the outskirts of Mahon and especially round Ciudadela, the countryside is sprinkled with small buildings of three, four, five, or even six courses of stones. The side view of one of these, as it appears on the skyline above the walls, looks from a distance like a pile of huge cheeses, diminishing in size from the bottom to the top.

Along with these circular edifices called *barracas*, rectangular ones are also constructed for the same purpose, with ridge-roofs called 'bridges.' An enormous quantity of material is needed to build quite small rooms in this manner, and such extravagant use of stones would be senseless if they were not superabundant in the extreme, if the problem were not merely how to put them together after collecting them to rid the soil of them, and if these buildings, at once primitive and modern, did not testify to a singular adaptation of man's building methods to his geographical environment.

As one travels over these two islands, where life is so hard and toilsome, one's thoughts recur unceasingly to the past. All this noise of picks and spades working the soil, all these repeated blows on piled-up stones, are the continuing echoes of an ancient tradition that confutes the demands of modern production. It is scarcely imaginable that a population of over 40,000 can live and flourish to-day on such an island as Minorca.

The Balearic islands are peopled by gardeners and fishermen; these island gardeners are mainly town-dwellers, and the fishermen are for the most part becoming, if not actual merchants in the strict sense, at all events coastal traders and carriers.

Miss Semple devotes a very long chapter of her *Influences of Geographic Environment* to the peopling of islands, and lays just emphasis on this "insular" association between cultivators and fishermen which to a large extent explains the great density of population that may be reached in such places.

Thus it is that men are attracted, preserved, multiplied, and concentrated by islands. But the latter become centres of expansion as well, for men, unlike plant and animal organisms, make their escape by sea. The excessive multiplication of life in a rigidly fixed environment gives rise, in fact, to compulsory migrations, or else to economic, social, or religious measures whose object is to restrict population.

The examination of these little isolated worlds must be based always on the observation of the 'essential facts,' and from these quite small natural units we pass on eventually to problems of wider range—problems of social or political geography and problems always of comparative geography. These are favoured fields of study for the beginner: the global study of these little human 'wholes' is the natural introduction to the study of larger units with more complex boundaries. In the front rank of units of this kind should be placed such areas as the old French territorial divisions, called *pays*—Woëvre, the Vexin, and Beauce, or Gros de Vaud and Gruyère, in Switzerland, etc. Then from these we are led on to consider and describe rather larger units—the Morvan, the Vosges, the Jura, etc.—and lastly still more extensive areas, of a political and historical rather than a physical character, such as the Netherlands and France.

On the subject of natural regions, both large and small, there has been a twofold movement of opinion. Some people, following the geologists, and reacting also against a false administrative uniformity and an artificial political grouping, have thought that the territorial divisions mentioned above—the ancient French *pays*—were a kind of fundamental constituent cells. Now, that is an exaggeration—almost an illusion. But search must none the less be made in the large political units for the basic principle on which a few real subdivisions were actually made. So it was that the 'natural region' appeared, resulting just as much from human facts as from geological or climatic ones. It is a result, not a premise, a combination, not an 'original condition.' It is the supreme proof of the connexions which it is the function of human geography to submit to critical examination.

"Two kinds of regions stand out above the multitude of secondary facts, and might be contrasted by giving them the simplified names of *geographical* regions and *historical* regions.

"*Geographical* regions, such as the simplest of the *pays*, are more or less extensive units all of whose parts have a certain number of similar or analogous features, geological, topographical, or climatic, so that, regarded as wholes, they are or tend to be *homogeneous*, and are legitimately considered, therefore, to be natural units. Their diagrammatic representation on maps, particularly geological ones, has emphasized this distinctive unity and made it more visibly evident.

"*Historical* regions, on the other hand, are composed primarily of several dissimilar natural units, and are therefore *heterogeneous*. They have been fashioned into political units by the human will —Normandy, Burgundy, Lorraine, and so forth. Now, human associations of a political character have such varied needs that their political solidarity is not only in accordance with, but finds its support in, the differences between the areas that go to make up their territory, which is at one and the same time their field of settlement and of food supplies, their zone of defence, and their base for expansion."[1]

The principle just enunciated has been applied in the following way to one specific area—North-eastern France:

"So far as the north-east of France is concerned, we shall find described and explained in the present volume, first the three principal physical regions—(1) the ancient Vosges massif; (2) the Lorraine tablelands; (3) the Rhine basin. Next will be described and explained the two historical agglutinations or concretions into which these different portions have been combined—namely, Alsace and Lorraine. We shall deliberately emphasize as strongly as possible this analytical classification of the regions into two groups—physical and historical—for we realize that after the regional method has been very successfully started it is essential, if it is to be maintained, developed, and improved, that this complementary critical principle should henceforth be introduced into it."[2]

It is quite wrong, therefore, to regard me as opposed to regional geography. But 'regional geography' interpreted in the widest and most general sense should be the synthetic culmination of geographical research, and not its analytical commencement. We have excellent examples of regional geography to-day, especially in French.

According to this 'experimental' method, which proceeds invariably by taking for more detailed study a few 'samples' chosen as typical, it is necessary to observe the relations that connect the essential facts of human geography with the facts of ethnography on the one hand, and, on the other, with the facts of what may legitimately be called either economic and social geography or political geography and the geography of history.

2. Human Geography and Ethnography

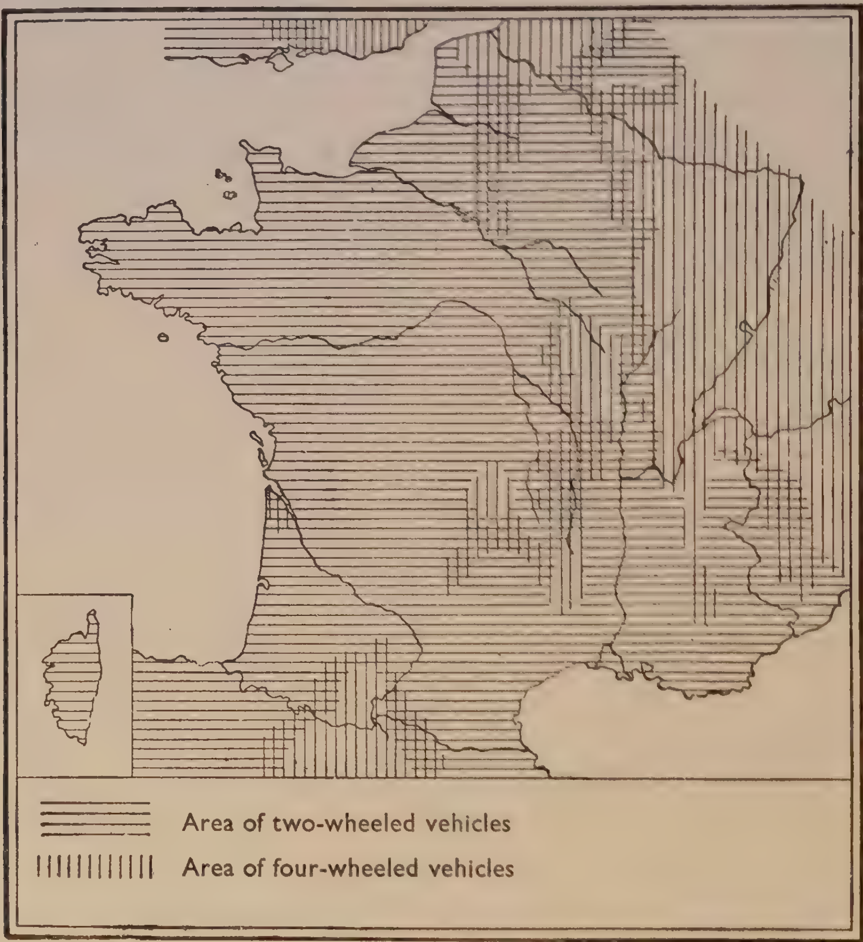
A close examination of the six typical facts in different parts of the world will very quickly show that it is the exception to find them expressed in a very simple form—what

[1] Jean Brunhes, *Géographie humaine de la France*, vol. i, pp. 369–398.

[2] Jean Brunhes, Preface to *La Région du Nord-est*, by Pierre Deffontaines and Andrée Choveaux (Paris. 1921).

might be called their bare form. They are generally surrounded and completed by another set of facts, equally visible and tangible, which form, as it were, their indispensable attendants. Even in their most rudimentary manifestations they are compulsory accessories, if the phrase be permitted.

Thus a house or inhabited cave is of no use without some furniture and utensils. A road undoubtedly requires such 'accessories' as means of transport, whether they be gliding sledges or



**Map XXXIII*

Distribution of Two-wheeled and Four-wheeled Vehicles in France

By Pierre Deffontaines

The four-wheeled vehicles form a kind of discontinuous line separating the two areas of two-wheeled vehicles—the Atlantic and the Mediterranean areas. It looks as if the victorious two wheels have divided up the ancient continuous domain of the four wheels. Generally speaking, the four-wheeled vehicle is Eurasian and continental, while the two-wheeled one, extending over several separate areas bordering on the four-wheel domain, is more coastal than continental.*

wheeled carts. (See Figs. 83–86 and Map XXXIII.) A field or garden is cultivated by man with the aid of such tools as spades, ploughs, and hoes. Beasts are controlled and driven by cords or leather straps, not to mention the complete set of harness that marks a more advanced stage of civilization. The gold-prospector and the quarryman use tools, and the hunter and fisherman their weapons and nets. All these various instruments—bows and arrows, the miner's pick, the horse's harness, agricultural implements, cart and canal-boat, cooking utensils and household furniture—seem to envelop and 'clothe' the material facts, just as clothing accompanies and covers the living reality of the human body.

All this material is bound to depend to some extent on geographical conditions, but relatively it is largely independent of them, and increasingly so in the case of civilized communities. It is free to a very large extent from the tyranny of the immediate geographical environment, thus enabling man to display more freely his own inclinations, whether spontaneous or traditional, impulsive or racial.

It would be a serious mistake, therefore, to place on the same level in human geography the fundamental facts and these 'objects' which are in the literal sense 'accessory' facts —for geographers, though not for ethnographers as well. Ethnographical facts, by their departure from the essential facts of human geography, get farther and farther away from geography proper, while remaining concerned, legitimately and of necessity, with geographical localization and distribution.

For the same reason and with the same rigour we regard the explanatory study of races and languages as outside the scope of human geography in the strict sense, because it is based on observation of a somatic or philological character whose connexion with geography is, and can be, only a very distant one. Races, it is true, have a part to play, and sometimes an important part, in human geography, and our recognition of this fact has been acknowledged. Work is needed to define this part clearly in each particular case, and that should be our task. So also geographical environment influences races, but how and to what extent it does so is another point that has to be clearly determined.

By means of working methods adapted to natural conditions and the collective training that results from them communities of shepherds or fishermen, miners or planters, etc., are undoubtedly changed, and eventually display definite tendencies. In this way they may undergo changes (*a*) in their physical aptitudes and (*b*) in their most inveterate moral and social habits.

The following three phrases denote three realities that have never been entirely co-extensive: 'Arab world,' 'Moslem world,' and 'Turkish Empire.' Why should the first fact—a racial one—be thought to be more directly explicable by natural causes than the religious fact or the political one? In *La Géographie de l'Histoire*, Chapter XIV, on the relativity of the conception of race, as well as in the following chapter on nationalities, nations, and states, the connexions and contrasts between ethnical and political facts have been carefully studied.

On the other hand, it is indisputable that a method of inquiry and analysis of the six essential facts is capable of rendering real service to all who have to observe primitive peoples. If these facts are 'full of geography' even in civilized countries—and that is what we have endeavoured to prove—still more will they give occasion for innumerable observations of a truly geographical character in lands inhabited by primitive peoples.

3. Social Geography

A great deal has been done by Le Play and his followers, direct and indirect, to throw light on *specialized* 'social types' and to present them to us as *localized* types. This means

that, whether consciously or not, they have laboured to give the educated public a better understanding of the characteristics from the human standpoint of the 'natural regions' —what we have called 'regional economies'—and also of what social geography ought ultimately to be.

We shall best realize how social geography finds its natural and normal place outside the group of 'essential facts' by reverting to the social conclusions of some of our monographic studies. Thus among the inhabitants of the Souf ownership is confined to planted trees. A certain right is created by effective and original labour. In an entirely different natural setting a similar notion appears, not unreasonably, to govern claims to property and the enjoyment of it. Remembering what was said in Chapter V about the Fang tribes of the equatorial forest and their many kinds of nomadism, we shall not be surprised to find that it never enters the heads of such folk, perpetually on the move, that any other race may live a sedentary life. Leading such a nomadic life, the Fang have quite a different conception of property from that of the European sedentary, to whom the soil is everything because it has been given real value by the age-old labour of his forebears. For the Fang, however, the soil belongs to no one: when a village is burnt down the Fang —using them as a specific example—merely laugh at the burning bark and the flaming huts so long as they have had time to place in safety their bales and bits of furniture.

Starting from a detailed study of watered gardens and irrigation canals and trenches, we have tried in an earlier work on irrigation in the Iberian Peninsula and North Africa (*L'Irrigation dans la Péninsule ibérique et dans l'Afrique du Nord*) to indicate some of the social conclusions emerging from a fairly extensive and more specialized investigation. There are some naturally dry regions where man introduces cultivation by means of irrigation. In this way he can modify the natural conditions to which he is subject. He does not create the water, but he uses what he discovers or what he can collect. He cannot, therefore, irrigate wherever he likes: some regions are condemned to irremediable aridity. As we have said more than once, irrigation works are possible only in certain natural conditions. This principle is obvious enough, but the conclusion to be drawn from it is often misunderstood. We must, in fact, get rid of the illusion that a cultivated oasis in an arid zone is capable of unlimited improvement, and that it is possible, for instance, to increase at one's pleasure the number of palm plantations in an oasis. Whoever attempts too much, and goes farther than natural conditions permit, makes the situation worse instead of better. Such examples as Lorca (South-east Spain), Bu Saâda (Algeria), Ghardaia, and the Faiyum are in existence to bear witness to this fact, and certain parts of the Nile valley and delta may perhaps provide us in the future with similar ones.

So although in many cases we seem to have brought Nature under our control, it still keeps the upper hand, for in every part of the earth it imposes restrictive conditions on our activities. These activities, restricted alike in their methods and their effects, are still subject to the influence of natural conditions, even within the limits wherein they can be exercised. Thus when the supply of available water is regularly subject to considerable variation, as in Valencia or Murcia, Sidi Bel Abbes or Msila, the cultivator of the arid zones will run the greatest risks if there is no definite organization to regulate its distribution, for he will be uncertain how much water he will have at his disposal. In such cases an attempt is made to find a normal and peaceful solution by a system of regulation, or even of administration, and the more capricious the causes controlling the supply of water the more drastic will be the former and the more authoritarian the latter.

Collective regulation is not determined directly by the natural conditions in operation,

but is the result of a state of mind itself determined by those conditions. We have said that there is a necessary connexion between natural conditions of irregularity and a certain general mental disposition on the part of the cultivators. This connexion is a necessary one, but it is strictly dependent—and it is as well to stress this point—on the nature of the needs of individuals which they consciously or unconsciously obey. The connexion is a necessary one as soon as the men living in these arid regions wish to engage in cultivation. If the same men led a nomadic life by rearing flocks and herds the equally necessary connexion between natural conditions and their own activities would be a different one. One of the factors remains constant, but the other varies according to human impulses, and so the relation between the two itself varies with the needs and desires that man seeks to satisfy. We ought not to generalize the necessity of this connexion, for it is a function of a factor that is always variable. We could give many more examples to justify and confirm the importance we have attached to psychological effects as transmitting agents between facts of the physical order and economic facts.

These considerations throw light on one last kind of observation. If it has been established that only by recourse to an economic and administrative organization of a fixed type can man draw the maximum profit from water and make the most complete use of it, it has likewise been established that this organization is not always the same: it is not the same in every oasis in the same zone, or even in all those of the same geographical type. Sometimes the free perception of this common interest results in those admirable 'hydraulic communities' of Valencia or Msila, and sometimes the State itself is led to co-ordinate the interests of individuals more or less skilfully, as in Egypt to-day. If the organized forms of human activity are to last they must always conform to the methods of this activity, or, at all events, to the stages whereby it becomes perfectly adapted to its geographical setting.

Social geography may be depicted on maps. *Some facts concerning it can even be shown by the aid of diagrams. Jean Brunhes and Pierre Deffontaines undertook this task by drawing typical *labour curves* for various agricultural regions in France (see Diagrams XXXIV–XXXVII), for "human geography should enter closely into agricultural life and seek out, define, and compare the peculiarities of the many rural ways of life."[1]

"In our view," say the authors, "the way of life is above all a combination of different kinds of work. . . . Our classification will be based on the organization of the cycles of agricultural work according to their rhythm—what might be called the 'works and days' of the French peasant. We shall draw charts, though these can obviously not be based on exact figures, for the activity of the countryside cannot be mathematically measured. The judgment of the persons concerned must be taken as the criterion. . . . Each district, therefore, will be represented by a typical labour curve, with its ups and downs marking the peak periods and the slack times."

World-wide investigations would have to be undertaken to set forth in this way the calendar of agricultural labour, and comparisons would be instructive. The consideration of these curves contributes to an understanding of the agricultural physiognomy of different regions, the types of cultivation and their requirements, the quality and quantity of man-power, the need for supplementary labour at certain times of the year, and even to determine the causes—apart from reasons of soil and climate, which do not explain everything—of the absence or presence of certain plants: colza, for instance, is being less and less grown in Flanders; its harvesting, which needs many hands, falls in June, when its place is taken by the pulling of flax.*

[1] *Géographie humaine de la France*, vol. ii, Chapter XXIX.

*Areas of Large-scale Cultivation

(Irregular curves, showing the need for seasonal migrations.)

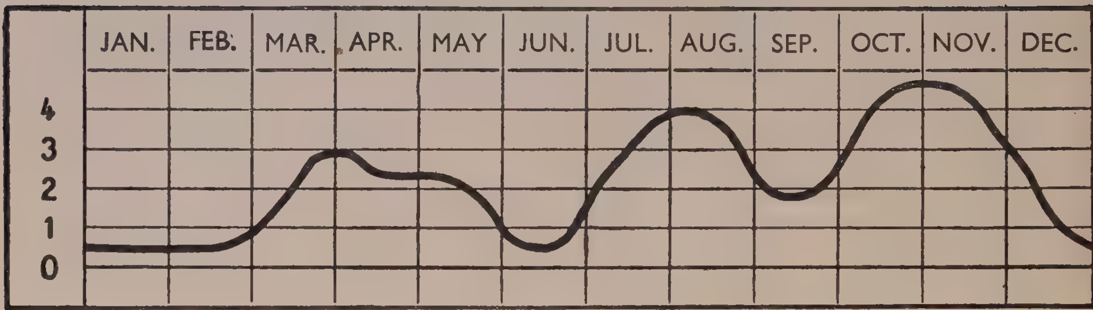


Diagram XXXIV

Agricultural Labour Curve in Lille Area

Autumn maximum, due to beet harvest, requiring intensive labour, exceeding even that of the grain harvest and generally involving a demand for seasonal workers.

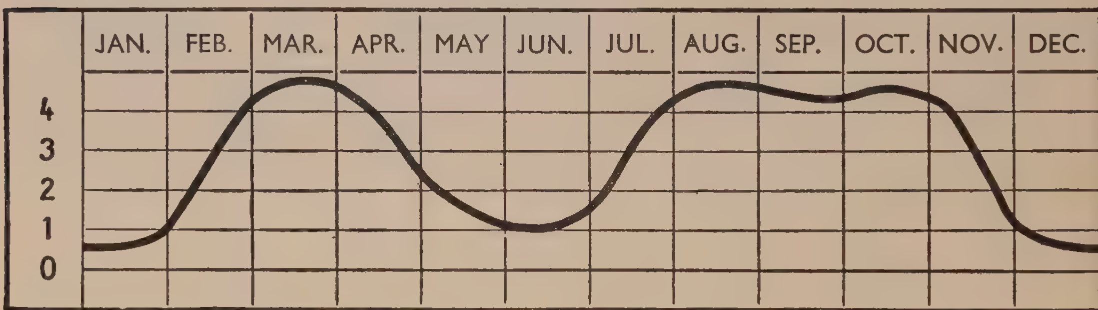


Diagram XXXV

Agricultural Labour Curve in Coastal Area of Flanders

Labour curve ill-balanced; importance of spring labour (weeding and hoeing) followed by period of very marked slackening. Two important demands for man-power, one in spring and one from August to November (late harvest combined with work on beet-fields).

KEY

Scale of Measurement (Approximate and Comparative) of the Agricultural Labour Curves for the Twelve Months of the Year in Four Typical Sample Areas

Above 4	Demand for seasonal man-power.
4	Local agricultural man-power fully occupied. Line 4 marks the maximum that can be furnished —12–14, or even 15, hours per day.
3, 2	Normal work. Local rural man-power normally employed—8–10 hours per day.
1	Local man-power partly unoccupied.
0	Complete collective idleness, never found anywhere among French peasants, except on principal feast-days.

*AREAS OF WOODLAND AND STOCK-RAISING

(Less regular curves: local man-power sufficient for all needs.)

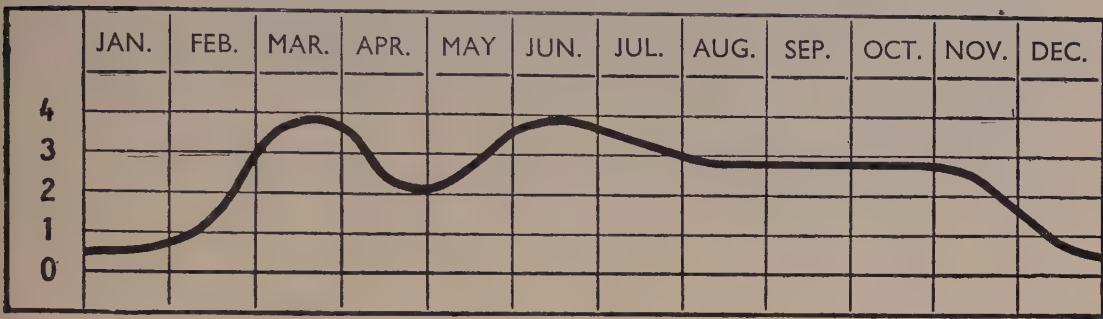


Diagram XXXVI

Agricultural Labour Curve in Boulogne Area

Area of transition where agricultural labour still has a place (March weeding), but June hay-making marks the highest point. In October the beet crop plays a smaller part than in preceding examples.

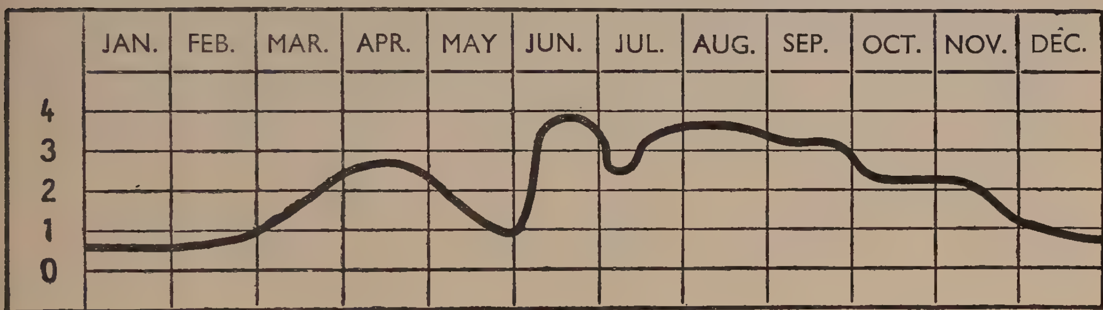


Diagram XXXVII

Agricultural Labour Curve in Dinan Area of Eastern Brittany

June maximum, but harvest period calls for almost as much labour. Little work in spring.

These four specimens of 'agricultural curves' are taken from Jean Brunhes and Pierre Deffontaines, "La Géographie humaine de la France," vol. ii, pp. 418–419, *by courtesy of the Société Nationale de l'Histoire Française.*

Each curve is accompanied by a commentary, of which the following is a specimen (relating to Diagram XXXVII):

In winter the leaves are collected and the pruning of the *quenouille*-trained oak-trees takes place. The meadows here are less well looked after, and the soil plays a larger part, so the fields are prepared by cutting down the brambles and repairing the banks by which they are surrounded. At the end of February the rape-seed is harvested, and in March the first ploughing of the year takes place, setting in motion the whole cycle of labour. Immediately after this the manure has to be spread on the fields: the meadows here are not often manured. Then in April there are the oats, cabbage, beet, and clover to be sown. In June the artificial feeding-stuffs are harvested, hay being of little importance, and the buckwheat is sown. After July 25 the harvest begins, followed at once by the threshing, done by horse-power. In September the stubble is ploughed up, the rape-seed sown, and the buckwheat and potatoes are harvested. October is taken up with preparations for the sowing, which continues till the end of November, and even into December in the case of wheat, for autumn ends very late in these lands that border on the ocean.

Social geography may be illustrated also by photographs. Figs. 116 and 117, for instance, are pictures of cultivated fields showing two different kinds of labour and, beyond what is directly visible, two contrasting types of social structure. One shows a Moslem land, where the work is done by single men organized in gangs, while the other is a Serb country, where the tradition of the *zadruga*, or family community, still persists, and the women and children take their part in the work.

For the entire subject of the social revolution caused by coal one should read again what Le Play says in *Les Ouvriers européens* (1877) about "the elements of social disorganization introduced into England a century ago by the exploitation of the coal measures." The people who crowd together to supply the labour for large-scale mining—which means coal-mining in particular—have no longer any fixed and strong attachments. The very nature of the coal-mine caused it to be the first object of exploitation calling for large amounts of capital, and this led to the birth and growth of the great joint-stock companies. The shareholders in these companies are far removed from the workers and unknown to them, while the workers are nameless to the shareholders. Hence have arisen those many acts of injustice and violence that have necessarily accompanied everywhere the special peculiarities of coal-mining.

To the coal-mines are attached, as we have said, all the principal forms of intense industrial activity. And so also to the human aggregations born of coal are attached the huge urban aggregations of the modern world. Whereas human beings seem to be increasingly massed together, they are in reality more and more separated from each other by the very necessities of the social geography of the great city. The mass of men and women who live in these cities, robbed of the attachment that fixes men to one spot of earth, and robbed, too, of a material home, and often of a moral one as well, become real nomads, moving from one house or lodging to another, and from the ever-rising tide and ever-renewed flow of these uprooted folk there results inevitably a certain measure of social anarchy. Such are some of the facts that go to make up the social geography of the industrial cities.

André Siegfried has painted a "political picture of Western France under the Third Republic" which stands in an interesting position on the boundary-line between social and political geography. Its precise documentation and numerous charts combine with the strict impartiality of the author to make this book (*Tableau politique de la France de l'Ouest sous la Troisième République*; Paris, 1913) a work of undeniable originality and novelty.

4. So-called Political Geography and, more generally, the Geography of History

Man enters into relations with his natural setting by the facts of his work, the house that he builds, the road that he travels, the field that he tills, the career that he carves out for himself, and so forth, and his work itself creates obligations, inclinations, and aptitudes which find expression in history. History is founded more and more on the minute investigation of social facts, like those just mentioned, and for this reason it is already linked with geography by means of this social intermediary. It is, in fact, by the mediating agency of work and the direct consequences that follow from it that the true connexion between geography and history is established.

The Geography of History reveals the logical hierarchy of all these human parts of geography. Here a few facts will suffice to show to what extent geographical investigation and explanation can throw light on the destinies of human groups, the interests that divide them, the struggles in which they engage, and sometimes even the almost tyrannical motives that incline their will in one direction rather than another.

When travelling through Palestine I was struck by the way in which certain of the Gospel stories took on a new and clear meaning when light was thrown on them by their geographical setting. Our Lord found no disciples among the peasants of his own town, Nazareth, but was followed by the fishermen of Tiberias. Now, the inhabitants of Nazareth are small, hardworking cultivators whose gardens can be seen on the hillsides, surrounded by white stone walls. Like all cultivators everywhere, they are compelled to remain on the land that they have to till, and their mental outlook is naturally bounded by the walls that border their patches of ground. They are by nature averse to novelty, and they are prevented by their work itself from setting forth on a random quest, even to follow the most attractive of leaders. The lake fishermen, on the other hand, lead a more mobile and irregular life by the very necessity of their calling. Fishing is a perilous business, depending largely on chance, and no enemy to adventure. Again, there are sometimes days of lucrative and 'miraculous' draughts of fish, which enable the fishers to take it easy for several days and make a holiday or a journey readily possible. We are not saying that the fishermen of Tiberias were compelled by destiny to follow our Lord, but the geographical conditions of their work and surroundings —with no fields or gardens around the little town—predisposed them far more than the cultivators of Nazareth to let themselves be led by the Galilean even to Judea. And they predispose us likewise to understand more clearly the things that history teaches us.

A similar contrast, shown with quite different intensity and over a far more extensive area, holds the secret, as it were, of much of the historical destinies of Asia.

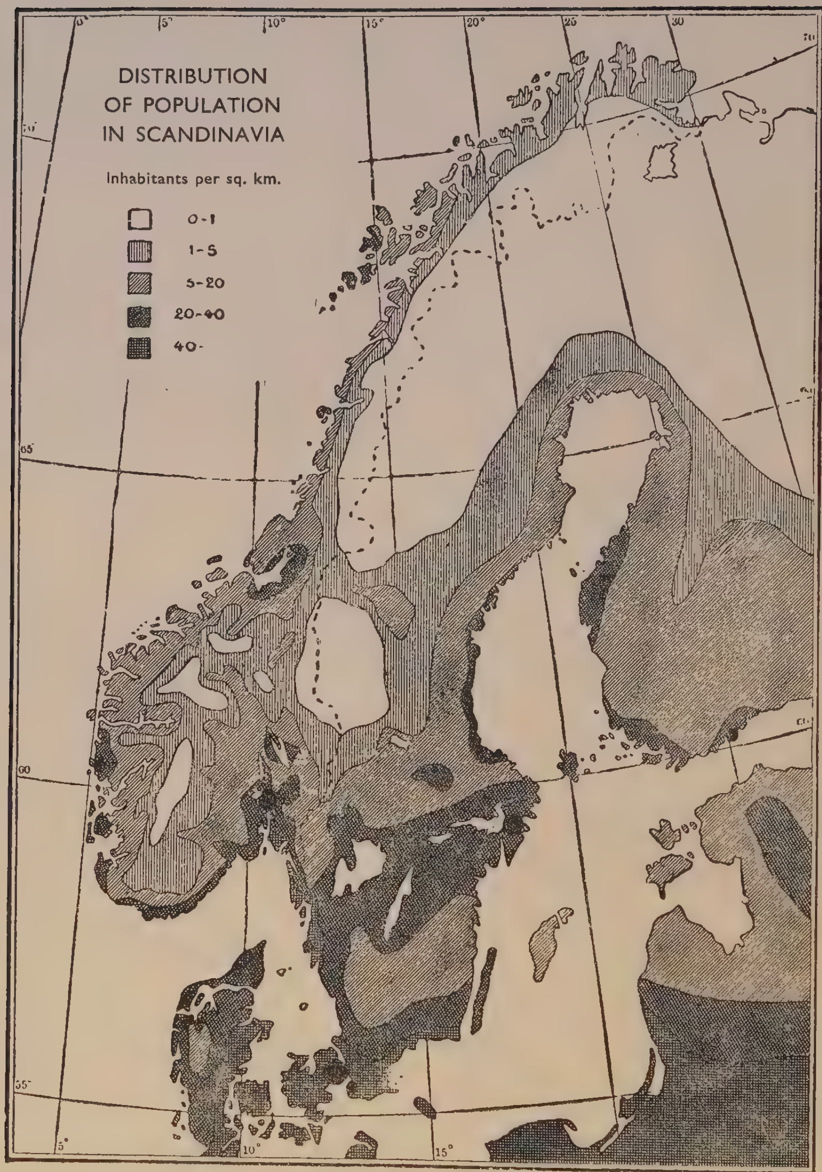
It is well known that the monsoon makes possible those many fruitful crops that characterize India, Siam, Indo-China, China, and Japan. In these countries a marvellous art of cultivation has grown up, and their abundance of foodstuffs is shown by the density of their population, which, though neither general nor uniform, makes this region as a whole the dwelling-place of one-third of the human race. In contrast to this the grassy steppes of Central Asia, with their rigorous winters, permit of no extensive exploitation of the soil. Only on the foothills of the mountains where the irrigated oases are situated does cultivation exist and flourish. Everywhere else the natural setting is conducive to the pastoral craft, and has been above all the realm of the mounted herdsmen — little groups of men scattered with their flocks and herds over a vast area, but having to be unceasingly on the move and to know in advance and from a distance the available pasturages and water-supplies. In this way, by the requirements of their everyday work, they have acquired a sense of initiative and strategy that has fitted them for the sovereignty of the region and the domination of their fellows. From these steppes have gone forth some of the greatest and boldest conquerors in history—Genghis Khan, Tamerlane (or Timur), and Kublai Khan. And it may well be affirmed that the qualities and faculties that gave such men their power can be partly explained by these steppes, by the aptitudes that characterize a pastoral people, and by their geographical subordination to their environment. Of these widely scattered herdsmen on the one hand, and on the other the densely packed masses of small-scale cultivators who swarm like ants over the whole of Southern and Eastern Asia, it is the former who have led the world: China, and even India itself, were ruled for centuries by Mongols or Manchus—in other words, by races of nomadic herdsmen.

It is certainly true that considerations of this kind do not serve to explain the details of history—particular political events and acts of individual initiative—but they do form, as it were, the explanatory substructure of the major political vicissitudes.

Here is another example of political geography of the highest importance at the present time.

According to a book on Norway officially published by the Norwegian Government for the Paris Exhibition of 1900,[1] "the ordinary maps of Europe, taking account only of absolute distances, have caused the idea to take root that the two countries of the Scandinavian peninsula form an organic

[1] *La Norvège* (Christiania, 1900).



Map XXXVIII

General Distribution and Density of Population in Scandinavia

This map, published by A. M. Hansen in 1900, shows the extent to which the two kingdoms have always been separated by a 'human desert.'

whole. This is true from the topographical but not from the anthropogeographical point of view. A map that takes into account the distribution of population in the peninsula, on the other hand, shows in a clear and striking manner the existence of a wide 'anœcumenic,' or uninhabited, zone between the two countries, and that is the case even if we allow for the encampments of the nomadic Laplanders on the northern tableland, and in spite of the fairly late immigration of the Finlanders, now very largely assimilated, who have to some extent peopled the region of the frontier forests in the south. To the east, therefore—the landward side—the kingdom of Norway is cut off from its neighbours with unusual sharpness, and there are few countries that form anthropogeographical units in such complete natural isolation." (See Map XXXVIII.)

An easy road and a pass, or, better still, an easy road over a pass, give rise to close relations between the two sides of a mountain massif. Thus the Duchy of Savoy extended its rule over both sides of the Alps, and for a long time included Lower Valais. What is this but the historical expression of the ease of communications and traditional intercourse between the Great and the Little St Bernard passes?

Although modern political incidents and vicissitudes and the prejudices that have long filled the heads of rulers and diplomats have caused to be built up, in defiance of geographical realities and historical facts, a kind of 'Foreign Office tradition' concerning the alleged watershed, and although to-day the boundary-line between two neighbour states cuts across the Great and the Little St Bernard, yet the abiding influence exerted for so many centuries by these two passes is still shown by one striking fact—that in all the valleys surrounding Mont Blanc the language spoken is French.

To go back into the past and rewrite the whole of history in the light of geographical facts it would be necessary to show the part played by roads—silk roads, salt roads, spice roads, and so forth—in the growth of historical relations between human groups. In small things as well as great would be revealed this determining influence of the highway, together with all those things, such as road crossings, railway stations, markets, and ports, that have been regarded in human geography as prolongations or extensions of the highway.

When Switzerland became aware of itself in early times a first centre of interest and resistance was formed by the union of the forest cantons, the reason being that the lake called the *Vierwaldstättersee*, or the Lake of the Four Cantons, was the crossing-place of the highways, or, rather, the great public centre of communications, trade, and political intercourse between the three mountain valleys whose streams flowed into the same sheet of water. These were the upper valley of the Reuss (the canton of Uri), the valley of the Muotta (canton of Schwyz), and the valley of the Aar (canton of Unterwalden). The first union of these three cantons took place in 1291. A further reason is that this same 'central station,' or, rather, this loose confederation of little bays or ports, led the peasants of the lower valley of the Reuss (Lucerne) to join those of the three other cantons in 1332. Thus it was the lake, quite naturally, that linked together the interests of the mountain and those of the sandstone plateau. That was the cradle of the Swiss Confederation because it was the nodal point of the early cantons, as well as of that association between alp and plateau that was, and still is, the foundation and the strength of the whole of Switzerland.

There are many great cities which originated in one or several small river islands, and were sometimes confined to them.

Such were the island of Lutetia (Paris), Kölln, that became Berlin, and the *insula Tiberina* of Rome. The reason is that this insular situation on rivers that are sometimes very easily navigable (like the Seine and the Spree), and always more or less so for the small craft of earlier days (like the Tiber), furnished easy means of access to human settlements, while the rivers served at the same

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time as lines of defence. The same applies to small islands on an arm of the sea or on a lake (Copenhagen, Stockholm, etc.) as well as to actual maritime islands like ancient Syracuse and Ortygia. In this case the historical advantages of the site are explained by the fact that the highway and the defence line are formed, so to speak, by the same geographical feature. (See Diagram XXV, p. 81.)

Conversely a dangerous area like a pass that is difficult to cross becomes quite naturally the 'site' of a highway. (See Fig. 37.)

In the high Alpine valleys a bridge is usually thrown across a stream just where the river-bed is narrowest and the current strongest—that is to say, between the two steep sides of an epigene gorge. Peat-bogs too are well-known hindrances to traffic, and that is no doubt why we so often find crossing-places—in Switzerland, for instance—bearing such characteristic names as Brugg, Brieg, Les Ponts, Pontet, Les Marches, Les Traverses, and so forth.

What matters above all to the geographer is to emphasize the influence exerted by orographical and hydrographical phenomena.

South of lake Garda, for instance, there is found the ancient *Zungenbecken*, or 'tongue basin,' of a great glacier—a magnificent unbroken morainic amphitheatre, studied and described by Fischer, Penck, and others, providing a bastion in the form of a semicircle of hills that prevent access to the lake by surrounding the approach to it. Against this bastion, beneath it and above it, hostile armies have many a time met in conflict, and the amphitheatre of glacial moraines is marked out by a regular series of battle-names—Lonato, Solferino, Custozza, and so forth—that recall and illustrate its geographical significance.

So we can never get away entirely from such geographical facts. Yet it would be a strange illusion, on the other hand, to imagine that we have merely to be governed by such facts, and that they alone suffice to explain all social and political history. Even in geography, therefore, we should never disregard all that results on the earth from man's free decisions and unconsidered actions.

The very deliberate act of the Brussels Sugar Convention in abolishing all export subsidies on sugar from September, 1903, reduced the area under sugar-beet and, so to speak, brutally wiped off the map of France thousands of acres of this crop. Again, the county of Sutherland, in the north of Scotland, was voluntarily depopulated at the beginning of last century when the agents of the landlords advised the Duchess of Sutherland to devote her estates to sheep-rearing instead of letting them to tenants who were bad at paying their rents. So the dwellers in the uplands were driven down to the coast, and the highlanders, who hated the sea, were forced to become sailors or fishermen. Such phenomena as these, that influence and engender peculiar population conditions, are dependent, beyond a doubt, on human causes.

There are laws that prohibit the roofing of houses with thatch or shingles. There are laws, too, for the compulsory division of estates on inheritance, and the indefinite subdivision of the shares. There are others that prescribe 'reintegration' of estates or institute inviolable family ownership. These are all legislative measures that have real and continuing effects on the surface of the earth. An ancient form of communal ownership of property, no longer in common use and unsuited to the present division of property, may keep excellent land in a fertile valley under collective control. Because the pasture is in this case common property all can pass over it, all can dry their linen on it, and even geese can be fed on it, and harm and sterilize the land by their droppings.

Until after the 1914–18 War a ring of fields all round Paris, immediately beyond the fortifications, was reserved under the name of the 'military zone.' It was definitely forbidden to build on it, or, rather, any building erected on it could be demolished overnight without compensation. In consequence of this administrative measure a belt of land in the heart of Greater Paris, between the city itself and the well-built, thickly populated suburbs, was withdrawn from the invasion of ordinary buildings.

In the Dobruja, a vast haven of refuge inhabited by a motley collection of racial groups that have been studied by Eugène Pittard, the German villages have kept their 'outlandish' appearance.

The growth of facilities for transport from a distance or for exportation have led, on the other hand, to a specialization of crops or of stock-raising in certain regions which could never have been undertaken otherwise.

In the interior of the district of Léon, in Brittany, cereal-growing of a mediocre kind has given place to meadows because markets for stock have been rendered possible. In this way, therefore, the economic importance and external appearance of this region have been completely altered by facilities for communication. In the districts of Vannetais and Cornouaille also the coming of the railway has stimulated the extension of the growing of cider apple-trees, whose fruit was required before the War by the cider industry of Württemberg, more than six hundred miles away. In the south of France Roussillon has developed its cultivation of fruit and vegetables, the valley of the Lot its peas and tomatoes, and the left bank of the Rhône, from Vienne to Condrieu, its apricots and peaches. Specialized and localized markets have grown up for the sale of these products—Cavaillon for melons, Lauris and Cadenet for asparagus, Caromb for apricots, Carpentras for strawberries, Thor for grapes, and so forth.

World trade and world communications—what the Germans call *Weltverkehr*—do indeed govern a great many of the phenomena of the three groups, such as towns, roads, crops, stock-raising, and the exploitation of minerals. This vast economic complex that is world trade is comparable to a physical geography complex, such as climate. Economic hurricanes have suddenly burst forth, scattering ruin alike over fields of sugar-cane and tin-mines even thousands of miles from the places where the commercial storm had raged. The peasant who sows his seed in Beauce or Podolia is no longer dependent on the weather alone: whether his harvest be good or bad in the physical sense it has been made economically good or bad by those vicissitudes of the commercial weather that might well be likened to the famous *Klimaschwankungen*, or 'climatic fluctuations.' Similarly, the lowering of transport rates sharply alters the economic distance between two places, exactly as if by a swift stroke of the pen, having the effect of a magic ring, the actual route itself had been made shorter or longer.

To sum it all up, the various states in their complex situation, even socially, have been subjected to the fluctuations of world communications. The economy of one country, such as Switzerland, has become a function of its railway connexions just as much as it is of those natural geographical factors that rule the lives of the energetic inhabitants of that particular piece of the earth.

It is impossible, indeed, to express the enormous extent to which cultural and industrial phenomena have come to be at the mercy of financial combines and the sovereign power of money. Yet in spite of all this the earth itself, rightly understood, still rules over interests, rightly understood. Geography, critical and methodical—clear information about the earth—should lie more and more at the foundation of all undertakings. Napoleon, who was undoubtedly able of his own volition to make some slight changes in the map of Europe, once wrote in a letter: "The policy of states lies in their geography." And so, too, in face of the greatly increased power of the Napoleons of to-day—the financial oligarchies—as well as of the social plans and visions of political collectivism, it may be repeated that all lasting policy and all effective economic planning must still be based to an increasing extent on geography.

Taken as a whole, the geography of history depends fundamentally on considerations connected with localized and regional phenomena, whereas social geography tends rather

to pick out the general influences to which men are subjected in consequence of certain efforts and certain methods of occupying the land. The geography of history should always have an explanatory aspect of a local, regional, or national character, while social geography leads, on the contrary, to conclusions that are less dependent on local variations.

In this sense social geography certainly makes it possible to understand more clearly what should be one of the results of researches in human geography. The aim should be to establish eventually a general human geography clearly based on the detailed observation of a thousand localized facts, but independent of regional geography to the same extent that general physical geography and general morphology are independent of chorography.

Chapter IX

THE GEOGRAPHICAL SPIRIT

1. The Geographical Spirit in the Economic, Social, and Historical Sciences

WHAT is the geographical spirit? The true geographer knows how to open his eyes and see things, but he does not see by merely wishing to. In physical geography as in human geography a training in seeing clearly the realities of the earth's surface will be the first step, and it is not the easiest one. Consequently the geographical method in all spheres where it can be adopted is a method that accords the first place to the exact, precise study of what exists at the present time, and that is its main interest.

Geographers should strive always to find out exactly *where* the phenomenon they are studying takes place. This concern with locality will have to be translated into maps and diagrams showing two kinds of facts: (1) the actual places or zones where the phenomenon appears at its best or greatest, and (2) the boundaries of the area over which it extends.

At the beginning of this book great care was taken to call attention to the geographical aspect of many kinds of work connected with the sciences of the earth, and stress was laid on the very fruitful development that had taken place in plant geography. This tendency is becoming more and more general.

"Human geography," writes Georges Gariel in the *Revue d'économie politique*, "is destined to give new life to all sociological theories that speculate on some kind of abstract man. For instance, the study made here of the various forms of ownership of water does away with 'all absolute and *a priori* theories, both those which take it for granted that individual ownership is the only form of ownership acceptable to the human mind and those which tend to regard collective State ownership as essential for all the countries in the world.'[1] Studies in human geography will be capable of rendering yet more services in this respect, and it must also be added that they will throw necessary light on the most delicate problems of *social art* that we have to solve."

Not only the economic and demographic sciences, but all the philological, ethnical, and historical ones also, are becoming permeated more and more by the geographical spirit.

To describe the distribution of certain village names or terminations (such as *ingens*, *ens*, etc., *loo* in Holland, and so forth), or even the distribution of distortions in pronunciation (*Gebel* in Egypt, *Djebel* in the Algerian and Tunisian Sahara, *Jdebel* elsewhere), is to throw light at one stroke on all the problems of historical philology that arise in regard to these different facts. Similarly, a map of saints' names is drawn up, and names derived from plants or land forms are examined in the light of geography. From this one is led naturally to give similar consideration to the actual distribution of all archæological phenomena and ruins, as well as legends and folk-lore.

Linguistic and ethnical geography are becoming increasingly essential to students of the problems of languages and races from the purely scientific standpoint. Artistic geography, which is part of the geography of history, deserves undoubtedly to be methodically worked out, for it enables many relations and connexions to be established between

[1] Jean Brunhes, *L'Irrigation*, etc., p. 439.

the physical setting and certain forms of art. It should be conducted, however, with as much prudence as patience, for if the relations are to be true ones they can only be mixed up with slight shades of difference, including always a large measure of relativity, and based principally on technical considerations. Even the history of philosophy, of religions, and of religious customs is concerned more and more every day with the accurate consideration of the geographical distribution of phenomena.

By following up all traces of mankind on the earth, step by step, various questions have been reopened and elucidated which were or would have been incapable of solution by the sole method of economic or political history, or the history of art or literature. Thus the creation and evolution of the medieval heroic epics—the *chansons de geste*—have been explained by Joseph Bédier, with a logic that surprised even himself, by connecting them with journeys.

These poems are generally at variance with history, but they fall into intelligible and interdependent groups as soon as one takes the trouble to localize them geographically. One such group—that of William of Orange—is simply a practical, utilitarian guide to, as well as a genuine echo in epic form of, certain facts of human geography—namely, the traditional pilgrimages along the Tolosa road that ends at the shrine of St James of Compostella.

Victor Bérard, after travelling along the shores of the islands and peninsulas of the Mediterranean with the Homeric poems in his hand, and comparing the ancient descriptions with the sailing directions of the Admiralty hydrographic service, has testified to the accuracy of the former, interpreting the Odyssey as a kind of voyage of information. "It is a geographical document," he says. "It is a poetic but undistorted picture of an indubitable Mediterranean, with its navigational methods, its theories of the world and of nautical life, its manner of speech, its nautical customs, and its commerce."[1] That shows what conclusions can be reached by the geographical spirit. More often, however, it has only a negative value, by eliminating from questions about origins all over-simplified or too theoretical solutions.

Again, all prehistory and anthropology are permeated by the geographical method, and some fundamental works in these subjects, such as the observations and synthetic conclusions of Marcellin Boule on the Grimaldi caves, are models of geographical criticism.

And so we come to history in the strict sense, and this is becoming more and more geographical. Following the example of Michelet, and taking advantage of all the progress that has been made in studies of this kind, every large-scale historical work is now preceded by a geographical introduction. Every historical work of the first rank starts with a good geographical sketch. But that is not all, for apart from this an endeavour is made to provide an explanation, in the fullest sense of the word, of history by geography. It is no longer a matter of a few typical facts, like those given in Chapter VIII as examples of the use of this method, but of a systematic tendency. Special historical problems, such as those relating to towns, frontiers, and so forth, those problems that are the concern also of human geography and have therefore been dealt with in this book, have quite naturally led historians along geographical paths. It was a very true observation of Clouzot that "the geographical idea has recruited followers even among historians."[2]

But geography can pride itself on still more decisive victories. It can lay claim to the partial ownership of some great contemporary historical works, even of the most important

[1] Victor Bérard, *Les Phéniciens et l'Odyssée*, vol. i, p. 6.
[2] *La Géographie*, vol. xx, 1909, p. 166.

kind. Thus Camille Jullian begins the first volume of his *History of Gaul* with a chapter on the structure of the country, in which he paints with great skill a general geographical picture, "following the methods and using the very terms in which the Greek and Roman geographers described the visible structure of the Gallic land." And the first two volumes of the *Histoire de la Gaule* are full of facts and reflexions of a genuinely geographical character.

But the work that seems to us the most important in this respect—the most novel and original, and at the same time the most knowledgeable in the matter of method—is undoubtedly that of Guglielmo Ferrero, whose history is as much bound up with geography as political history continually is with economic history. His study of "Wine in the History of Rome" is very typical of his method.

> "At the beginning of their history, and for long centuries thereafter, the Romans were water-drinkers. There was little wine made in Italy, and that was only of poor quality." The rich alone occasionally drank Greek wines. "But as the rule of Rome spread through the Mediterranean world, so the vine spread through Italy, by a kind of law of correlation. . . . And the connexion between these two phenomena—the progress of conquest and the progress of the vine—was not fortuitous, but organic, essential, and intimate. For with the growth of the expansionist policy wealth and culture increased in Rome, and as a natural consequence the traditional spirit of simplicity weakened, luxury increased, and the desire for enjoyment and the taste for intoxicating liquor spread more widely. . . . For a century and a half after 130 B.C. or 120 B.C. the progress of the vine continued without interruption. . . . The vine, it may be said, was one of the bases of imperial authority in Italy." Ferrero draws a comparison between the invasion of Hannibal at the end of the third century, lasting seventeen years, and endured with reasonable patience, and the revolt of Spartacus, which was in itself less serious than the fears of the enriched middle-class peasants caused them to believe. And Ferrero explains this difference by the changes that had taken place in the fields and gardens: in Hannibal's time it was cereals and pasture; in the time of Spartacus vines and olive-groves, crops requiring long and patient toil and, once destroyed, replaceable only at the price of costly effort, continued over several years. "Little by little the Emperor became as it were the tutelary god of the vines and olive-trees—in other words, of the fortunes of Italy. . . . The owners of the vines and olives, whose wealth was nearer to their hearts than the great traditions of the Republic, set the image of the Emperor among their household gods and worshipped it as they had formerly worshipped the Senate."[1]

Surely what is new in this treatment of history is the search for reality on the earth's surface, and for the varieties of what we have called the essential facts of human geography? There is a 'geographical sense' that calls, as it were, for a more realistic understanding of all the manifestations of human activity, economic, historical, and political. To see the precise forms of terrestrial reality, to see them in their entire physical distribution and right up to their zonal boundaries, to distinguish the varied forms that they take in different places—these are the commandments laid down by the geographical spirit.

2. The Geography of Infectious Diseases, Endemic and Epidemic, in its New Relation to Human Geography

There is perhaps no form of strictly scientific research that has confirmed the legitimacy of geographical inquiries and revealed strange and very close connexions with human geography to such an extent as the most recent studies of endemic and epidemic diseases.

[1] Guglielmo Ferrero, "Le Vin dans l'histoire de Rome," in *Revue hebdomadaire*, January 16, 1909, pp. 281–304.

Is there such a thing as medical geography? It might be more accurate to say that there is geography of diseases. This has been clearly demonstrated by the discoveries of the last few decades. Why is this? Because there is undoubtedly a geography of the rodents, insects, ticks, and mites that transmit malaria, yellow fever, typhus, plague, and all the diseases caused by trypanosomes. The connexion between man and his natural environment is brought about through the agency of other living beings, and these must themselves be studied first.

The first step in the investigation should be a geographical inquiry into the zones where a certain disease is prevalent, and, if possible, a graphic representation of these zones. A start has been made with this: the connexion between marshy regions and malaria has been shown by typical maps like that reproduced in Theobald Fischer's *Penisola Italiana*, and research into sleeping sickness has begun, as it should, with an inquiry into the regions afflicted by this scourge. It appeared that there was a real correspondence between the parts of Africa where this disease is found and the parts infested by the tsetse fly, that enemy of cattle and horses which inflicts on the hot and moist parts of Africa the terrible economic handicap of being deprived of all domestic animals. And researches have now been set on foot to discover the responsibility of the tsetse or one of its near relations.

Geography, however, does not stop there. I have often discussed these questions with my colleague Dr Nattan-Larrier, Professor of Pathological Protistology at the Collège de France, and it seems to me important to call attention, with his competent and authoritative assistance, to the human consequences of some of the newest, most indisputable, and most significant scientific discoveries.

Much light has been thrown on the geography of diseases, whose object is to mark out the domains of diseases caused by bacteria, protozoa, and helminths, by the pathology of tropical countries. But if the microbes that cause human diseases seem to be confined to certain centres it is not only because they find there the climatic conditions necessary to their development. The viruses of the so-called tropical diseases can, in fact, be easily preserved in the laboratory. Thus it was found possible in 1903 to bring to Europe the pathogenic agent (*Trypanosoma gambiense*) of the **sleeping sickness** that is endemic in equatorial Africa, and even to-day in bacteriological institutes it retains all its special characteristics. The domain of the viruses, therefore, is less restricted than that of the carrying agents. These facts can be explained as follows. Sleeping sickness is transmitted to man by the bite of the tsetse fly (*Glossina palpalis*), the usual host of *Trypanosoma gambiense*. The area of distribution of the human sufferers from trypanosomiasis is contained within the limits of the regions where *Glossina palpalis* can live. The endemic focuses of **yellow fever** lie between the latitudes 40° N. and 40° S., and the distribution area of the fever is at present situated in Africa and America in the zone frequented by *Aëdes ægypti*, the mosquito that carries the disease.

The first conclusion, then, is this: that **the geography of these diseases is not determined by the direct dependence of their pathogenic agents on atmospheric conditions, but is governed by the biology of the insects that are the secondary hosts of their viruses.**

Now, it is evident that these stinging insects which inject these infections are not evenly distributed throughout the zones where they are able to live. They multiply only at points where they find such temperature, vegetation, stagnant water, and conditions in general as are essential to them. Man can therefore constantly intervene to change their distribution, to favour or stop their breeding, and even to make them disappear (by altering the flow of water, deforestation, and so forth). Thus the geography of diseases, animal and human, in hot countries, does not stay fixed and unalterable, but is subject to the influence of economic factors of the most varied character. The most famous examples of the connexion between what is called tropical pathology and human geography are the outbreak of **malaria** at Ismailia when the Suez Canal was being dug, and then its extinction

when the destruction of the anopheles was undertaken by the methods of Sir Ronald Ross; the spread and increase of **yellow fever** at Panama, followed by its elimination when the American mission under the direction of William C. Gorgas was able to organize the fight against the *Stegomyia*; and the growth of **sleeping sickness** in the Congo basin.

So the second conclusion to be drawn is that **man intervenes, whether consciously or unconsciously, either to combat or to increase the growth in numbers of the insects (or other creatures) that serve as secondary hosts to the pathogenic agents.**

Recurrent fever occurs in Russia, Algeria, Tunisia, Egypt, and India, and **exanthematic typhus** in Poland, Russia, North Africa, and Tibet. The virus of these two diseases, however, is injected by a common insect—the head or body louse—which finds the conditions essential to its multiplication everywhere, in temperate, northern, and tropical zones alike. It follows that the delimitation of the endemic foci of typhus and recurrent fever depends not so much on this insect's distribution area as on human habits and the characteristics of modern community life. The endemic foci of these two diseases coincide with the permanent centres of dirt or poverty. As for the great epidemics sometimes caused by these diseases, they break out when the hygienic customs gradually created by modern civilization are broken down by economic disturbances.

So the third conclusion is that the **general conditions of human geography, whether permanent or temporary, are the indirect but real supreme cause of most epidemics and endemics, because they favour the growth of the secondary hosts.**

Lice too were one of the scourges of all the armies in the First World War from the earliest months of the War down to the end of 1915. The entry into France of 'carriers' of the germs of recurrent fever and exanthematic typhus was successfully prevented, so that lice could not disseminate the pathogenic agents of these diseases. But, on the other hand, they did spread a special kind of fever called **trench fever.** From 1915 onward thousands of cases of this infection were seen in the British sector, and the epidemic was making progress everywhere in 1918, but it suddenly disappeared when the men returned home and were able to resume their normal life, rigorously cleansed of their parasites.

In the period before the 1914–18 War the progressive diminution in cases of **malaria** in France was not due, as was thought, to the complete destruction of the mosquitoes that are likely to transmit Laveran's hæmatozoa. *Anopheles maculipennis* is still met with, not only in regions where malaria was once prevalent, but at places where no one remembers ever having seen intermittent fevers. Now, when war came the mosquitoes, which deposit their eggs on stagnant water, found very favourable conditions for their development in the fighting area. Moreover, the anopheles might infect themselves, for there was no lack of germ-carriers: no matter how much care was exercised in selecting contingents from men of other races they were often recruited in lands where malaria was still rampant, and so in many parts of the front there were subjects who, though relatively immune and without themselves being ill, continued to harbour parasites in their blood, and were ready to spread contagion around them by infecting the mosquitoes that chanced to sting them. When the War was over there came into play the same general factors of human geography as had already made it possible to rid France of malaria, and now again brought about its extinction.

More serious was the menace of **amœbic dysentery.** It was known that *Entamœba dysenteriæ* is transmissible from one person to another by contact, without the intervention of a host. So it might be thought that dysenteric focuses would be formed if a number of germ-carriers were congregated in an environment in which the elementary rules of hygiene were fatally neglected, and these conditions were found to be realized here and there. It was known that the dysentery amœba was very often found among the members of native contingents, colonial troops, and regiments that had been in the East or in Egypt. Dysentery attacked men of the home armies who came into contact with the sick in the trenches, in billets, and in the hospitals. But the principal point that was noticed was this: that there was for the most part no direct infection; a subject who seemed healthy but was actually infected had spread the cysts of the parasite in the trenches. Just as the parasite is found in the sodden soil of the rice-fields of the East, so it throve in the front-line mud that fouled clothes, hands, and food alike, retaining its virulent qualities for more than ten days. The

disease died out when the rules of hygiene were again observed, and when the amœbæ no longer found conditions favourable to their survival in their external surroundings.

Apart from exceptional circumstances like those of war, the study of such contagious infections as **leprosy** has shown that the geography of diseases is governed primarily by factors of human geography. The reason why leprosy has remained a tropical disease is that all the economic factors favouring its diffusion in Europe in the Middle Ages are still in existence to-day in many hot countries.

The migrations, in both directions, caused by the 1914–18 War not only brought foreign diseases into our country, but caused also the introduction into tropical regions of infections belonging to temperate ones—bacillus diseases transmissible without the agency of hosts. **Tuberculosis** has succeeded in penetrating into the French colonies of Western and Equatorial Africa, where it had never before been found, and **cerebrospinal meningitis** has also reached lands where it was formerly unknown. **Influenza** above all spread throughout the whole world between 1918 and 1920, causing frightful ravages. The history of an epidemic like this proves how small is the part played by climatic factors in the geography of diseases.

In the Congo, Uganda, East Africa, Abyssinia, and Madagascar there is a kind of tick that causes **recurrent African fever** if it happens to sting a man after it has ingested a certain virus. It transmits to its offspring what is called *Dutton's spirochæte*, the pathogenic agent that produces this infection. So wherever this insect lives the disease may develop.

In general, however, stinging insects become dangerous only if they have themselves ingested the viruses by feeding on the blood of the living creatures that house them, whether permanently or temporarily. The carriers of germs can therefore introduce a disease into a country where it has not yet existed, but where its appearance is possible because the insect that can inject it is already there. Individual movements sometimes, but more often the migrations of native tribes or the importation of foreign workers, have been responsible for a similar diffusion of disease. (See Map XXXIX, opposite.)

In connexion with these facts relating to the deadly African ticks, we are pleased to set down the following, which we owe to the unpublished report of General Blondlat:

"In all the colonies where I have been the natives burn down the bush, and the general reasons for this custom are easily given: it is to destroy reptiles and other vermin, to drive out the wild beasts, and to use the potash from the ashes for manuring the low-lying lands and cultivating for two or three years land that has long remained untilled. As a general rule we strictly forbid this

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Map XXXIX

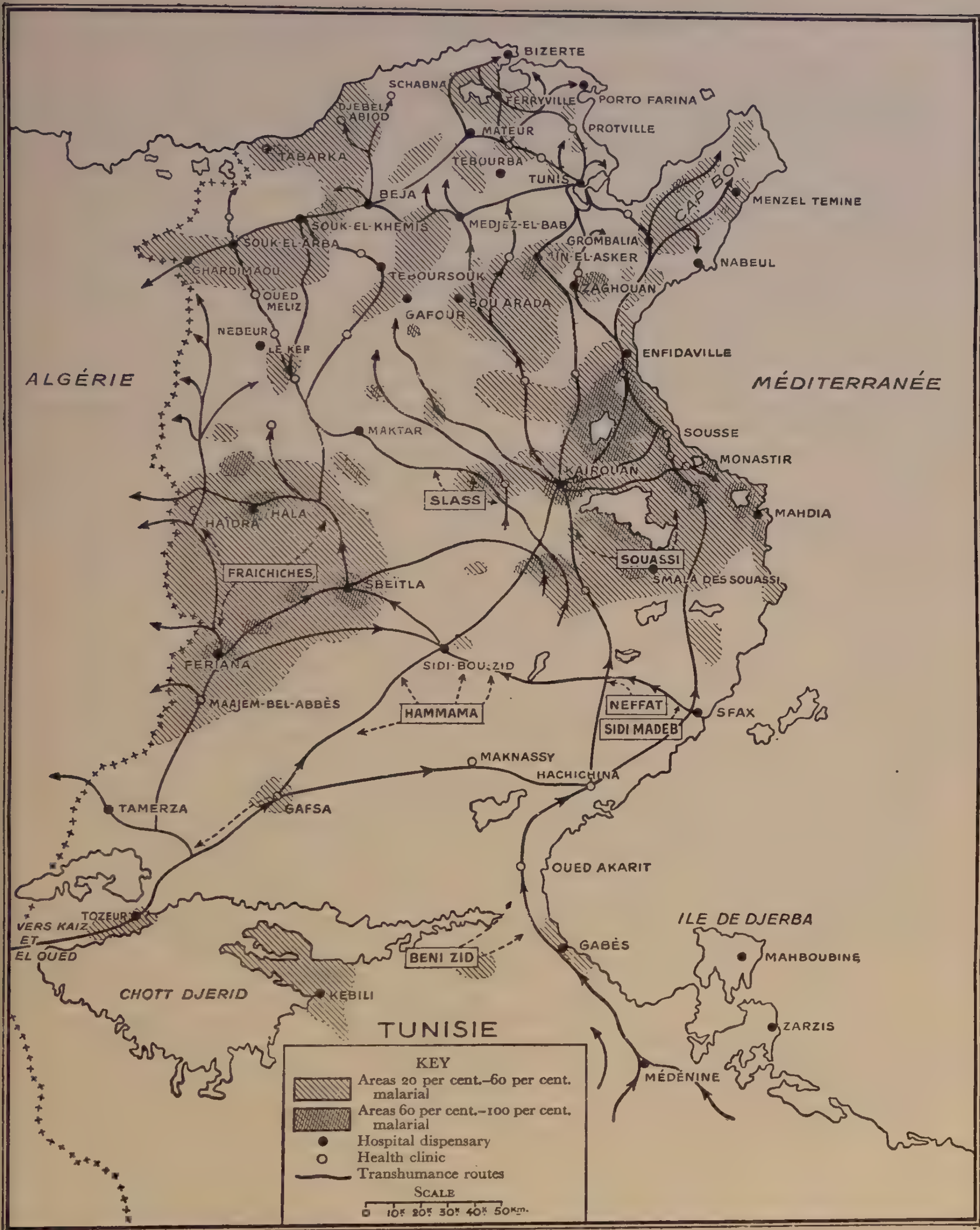
The Most Malarial Areas in Tunisia in Relation to the Principal Transhumance Routes and the Sanitary Centres established in Connexion with the Anti-malaria Campaign

The development of land by irrigation and drainage in the Roman era undoubtedly saved the country from the serious epidemics of malaria that occurred later on. The centuries of invasions that followed enabled the malaria scourge to grow, and epidemics were encouraged by the neglect of cultivation and hydraulic undertakings and by the spread of nomadism.

The distribution of the anopheles follows closely the distribution of water surfaces favourable to pollution. (It is for this reason that colonization has created good harbourage for them by canalizing water and sinking wells.) And the spread of malaria is favoured by periodic movements of population, which can be divided in Tunisia into three classes: *large-scale* displacements, taking considerable groups of people northward at times of fruit-picking and harvest; *medium-scale* nomadism, caused by the requirements of the flocks and herds; and *small-scale* nomadism, that of habitual vagrants. Particularly serious are the movements due to meteorological circumstances: thus in times of drought there is a search for water-spots and an invasion of places hitherto uninhabited on account of their unhealthiness. Markets and places of religious pilgrimage are also centres of disease to which the natives come periodically and get infected.

To wage effective war on malaria the Tunis Board of Health has prepared pictures and maps (reproduced in Dr Charles Henry's book) showing the transhumance routes, the importance of the movements of population, and so forth, and on these geographical foundations it has been possible to plan a campaign against malaria, particularly by setting up hospitals, dispensaries, and health clinics at the principal points that the nomads pass through.

Based on information derived from Dr Charles Henry's "La Lutte antipaludique en Tunisie" (Paris, 1939)



Map XXXIX

[*See opposite for legend.*]

bush-burning, for fear that the fire may spread to the forest and because wise forestry instruction has taught us to regard vegetation everywhere as precious. One day an angry old man asked me why the French had resolved to make all their cattle die by forbidding the people to burn the bush. . . . Now at that time I could not possibly establish any connexion between that cause and that effect. As South Africa had not long before become short of cattle on account of the Boer War, I had the idea of bringing some oxen from the west and embarking them at Fort Dauphin for Natal and the Transvaal. But meanwhile we learned that the English in South Africa were prohibiting the importation of our cattle because those of our second consignment had all, or nearly all, died! The veterinary surgeon found that the cattle had died of **Texas fever.** I asked him about the nature of this disease, and he told me that it is transmitted to oxen by ticks that live in the long grasses. Our cattle, passing eastward from the dry cactus area to the region of the (unburnt) grass had been stung on the way by these ticks. So the old native was right, and we had to allow the bush to be burnt, just as the long grass in Texas is burnt to destroy the larvæ of the ticks."

To continue our examination of infectious human diseases, it should be noted that one of the most dangerous animal transmitting agents is the rat. There is in Japan, particularly in the western and southern parts and on Shikoku island, a disease characterized by **yellow jaundice accompanied by hæmorrhage and relapsing fever.** This hæmorrhagic icterus is very prevalent in coal-mines, where it takes an extremely serious form. The rat, a veritable storehouse of viruses, shows no morbid symptoms, but is continually eliminating the parasite by way of the kidneys. This parasite, thus diffused externally, comes into contact with the mucous membranes and teguments of human beings, passes through them, and causes an infection that brings death in more than one-third of the cases. This Far Eastern disease appeared on the Western Front during the 1914–18 War, for rats had multiplied in the trenches. Thus the ætiological conditions previously observed only in the coal-mines of Japan were reproduced here: the rodents had transmitted their virus to the soldiers.

Cholera has managed on several occasions to escape from its Asiatic centres and reach France, where it became very serious. But it never took root, and disappeared completely in the intervals between the epidemics, thanks to our sanitary machinery and the rules of hygiene.

Plague is transmitted to man by the combined action of an animal and an insect—the plague rat and the rat flea. It depends, therefore, first on rats, which may become plague rats, and then on fleas which transmit the disease from rats to men. To the precise extent that the number first of rats and then of fleas is reduced will plague be successfully warded off. There are some houses that are particularly accessible to rats—houses where they can enter and have a free run, as they do in the cellars and sewers of our great cities. Such houses—ideal homes for rats—are those that are built right on the bare earth. If we wanted to describe these observations picturesquely in terms of human geography we might almost say, though it would be rather prejudiced and far-fetched, that plague means rats, and therefore that it means pre-eminently and primarily houses whose 'floors' are the earth itself.

The persistence or the limitation of certain of the most important human diseases is, in fact, governed by conditions of human geography very directly connected with those groups of facts that we have classed as essential, such as houses, mines, rice-fields, flocks and herds, and so forth. Every new discovery of a true pathogenic agent leads to the assertion that it is indeed human geography that explains or reveals the diffusion and extension of a disease, even when the latter had long appeared to be strictly localized. For instance, **undulant fever** is to-day spread over the whole world. It was in Malta that it was first studied and its microbe discovered, so at first it was called 'Maltese fever.' But soon it was found along the entire coastline of the Mediterranean, and later even in the interior of the countries that surround that sea. Still later it has been found that there are few areas to-day where it does not occur. The same effects have necessarily been produced everywhere by the same causes, in town and country, in tropical and temperate lands alike. Now, Bruce's microbe, *Brucella melitensis,* is nurtured in the milk of milking goats that are apparently perfectly healthy, but are capable of carrying the microbe wherever they may be taken. They infect the native goats, and these in turn may transmit to human beings the melitococcic infection. Undulant fever is

particularly prevalent in poor countries and mountainous regions. It attacks not only those who consume raw goat's milk or cheese made from goat's milk or ewe's milk that has been insufficiently fermented, but also those who are brought by their profession into contact with sick animals.

To sum up all this, it may be said that **the risks incurred by men from germ-carriers, whether animal or human, increase in proportion to the multiplication of relations between them** and the increase in number, speed, and cheapness of means of transport. Caravans sow diseases on their journeys, while railway-trains, cars, and aeroplanes enable infected persons to reach their destinations and introduce their diseases into lands whose distance has hitherto been their best defence. Moreover, since animals, both wild and domestic, are themselves storehouses of viruses, man makes himself the propagator of the diseases he dreads when he imports cattle or draught animals from long distances and in a short time.

There may perhaps come a time when we shall no longer speak of 'foreign' infectious diseases. If certain contagious diseases that we call 'tropical' are prevalent in countries that lie in or near the tropics the principal reason is that **the extreme density of the population, the somewhat primitive living conditions, or the necessary requirements of certain crops have made it impossible, or possible only with difficulty, to effect any general improvement in the conditions of community life and to induce these peoples to observe the strict rules of hygiene.**

It will be acknowledged that a new philosophy emerges from all this observation and study of infectious diseases. Learned biologists and microbiologists were guided by the geographical spirit in their very careful ascertainment of the principal breeding-grounds of these diseases. And, contrary to all expectations, this spirit has led them to call directly upon a branch of true geography—human geography—which was undoubtedly regarded at the outset as of purely secondary importance.

*It is for this reason, it might now be added, that it will be possible to fight more usefully against the spread of disease. In fact, Dr Philippe Decourt declares, speaking of malaria, that "the antiplasmodial fight should be based on the study of human geography," and that "there will be found in Jean Brunhes' *Géographie humaine* a description of the three groups of activities—unproductive, creative, and destructive—and of the six types of essential facts arising from man's sojourn on the earth. All these types of facts play an important part in the spread of malaria, and a knowledge of the 'facts of movement' forms one of the bases of the antiplasmodial campaign—*i.e.*, the fight against malaria."[1]

"To launch an antiplasmodial campaign in one village without taking account of human intercourse between it and neighbouring villages is to run the risk of considerably restricting the results that are looked for. Moreover, the plan of such a campaign should not be drawn up for any district until all the 'facts of movement' have been sought for. After observing these facts in countries of very varied character we believe that they can be classified as follows, to facilitate systematic research. Movement may be brought about by:

(*a*) **Commerce,** including *fairs*, where both buyers and sellers move; *markets*, where only buyers move; and the *packman* system, where only the sellers move.

(*b*) **Stock-raising,** which involves nomadism.

(*c*) **Seasonal forms of cultivation and industry**—migrations that play their part not only in regard to movement, but just as much by the changes they cause in the density of the population.

(*d*) **Non-seasonal forms of industry and cultivation using imported labour** renewed by continuous double migration.

(*e*) **Religion,** involving pilgrimages.

(*f*) **Administrative and military life,** involving changes of residence."

In this explanation, permeated as it is by geographical considerations, the author notes that the lower the density of population the more serious is endemic malaria—a point of capital importance.

[1] This and the following quotations are from Philippe Decourt, "La Lutte antiplasmodiale, ses facteurs humains," in the *Bulletin* of the Société de Pathologie Exotique, vol. xxxi, 1938, pp. 59–68 and 138–147.

As malaria increases its economic accompaniments speedily make themselves felt, in such things as less careful cultivation and harvests jeopardized. The result is a lowering of the standard of living, frequently even under-nutrition, which in its turn increases the gravity of the disease.

Fortunately, however, equilibrium may be broken in favour of man and against malaria. Regions made sterile by disease become populous once more. In the upper Jezireh, in Syria, a region deserted for centuries, the town of Kamechlie has been created. The density of both population and cultivation has rapidly increased, and better feeding gives the people greater powers of resistance. "The factor that breaks the vicious circle is the tenacious will-power apparent in the spirit of the colonist faced by new lands. . . . In Annam, on the border of the thickly populated regions, a progressive extension of cultivation is taking place: each year sees some little hillock newly planted or a small valley just brought into cultivation. The Annamite peasant who cannot go and settle a dozen miles away because of malaria is gaining ground in these very regions none the less. If the metaphor is permissible we should be tempted to say that the peasant in these parts is *pushing his crops in front of him* to serve as a shield enabling him to cope with regions which he could not otherwise have approached."*

Geography, then, is no longer referred to merely to obtain methods: it is called upon —such is, indeed, the final conclusion—because it holds the secret and provides the fundamental explanation of the distribution of a certain number of cases of infectious disease. This aspect has ever since become a kind of principle of rigorous and universal application. The geographical and social conditions of life, and consequently the 'ways of life' themselves, appear more precisely than ever as factors in health and disease.

3. The Psychological Factor in the Connexions between Natural Phenomena and Human Activity

This habit of seeing realities where they are and as they are has the effect of instilling in the mind a well-founded mistrust of mere labels and giving it a critical sense of the varying value of geographical realities.

Thus mountains seem as a general rule to imply the absence of all human life. But it is obviously a mistake to generalize this idea, for in certain latitudes and climates the higher regions are the most inhabited ones (as in Mexico, the high Andean tablelands, and so forth). Even in our own European countries a mountain region may be regarded from the point of view of human geography as a natural region, having its own way of being inhabited and exploited. (See Chapter VII for the Val d'Anniviers.)

So, too, the term 'river' will call up very different images according as we envisage equatorial regions, where, owing to abundance of rain and vegetation, the river and its banks form a scarcely divisible whole, or such northern lands as Canada or Siberia, where the rivers are frozen for more than half the year, or, again, the rivers of our own part of the world, with their regular beds and stable banks on which men can establish themselves permanently.

A comparison of different towns or villages having the same population is bound to reveal the different realities to which the same name is given—differences in the way they are built and inhabited, scattered or closely packed together, placed like Calcutta in the midst of an over-populated area, or surrounded, like Peking, by sparsely inhabited suburbs.

Between facts of a physical character there are sometimes causal relations, but between facts of human geography there are hardly any relations except those of co-existence. To strain, as it were, the bond that unites phenomena to one another is unscientific. And the critical attitude will be very necessary here if the many cases in which the connexion is by no means a causal one are to be clearly discerned. The principal endeavour

of this book is to illustrate in a positive form similar cases of connexion between man's activities and his physical surroundings.

"Do you know any less hospitable places in the Mediterranean than that little corner of the Syrian coast where once stood the ports of Tyre and Sidon, so famous in bygone days? There are scarcely any. The sites are bad in themselves, and very often a heavy swell from the open sea prevents any entry or departure. (See Fig. 49.) There is nothing here of the kindness shown by Nature to the Greeks, upon whom were showered the blessings of an infinitely indented coastline adorned by a fringe of islands. Yet the Phœnicians were a great navigating and colonizing people. Why? Because their skill as traders made up for the unkindness of Nature, and because they desired at any cost to be the commercial intermediaries between the great empires of Western Asia and Egypt on the one hand and, on the other, the distant lands of Spain, Gaul, and the British Isles."[1]

Hence there arises a complication which sometimes makes it hard to determine the actual bond between man and Nature. This connecting bond is, in fact, variable because it depends on man's wants—both his spontaneous and his considered desires—and these psychological elements, being by nature extremely variable, necessarily cause the relations even between earth and man to vary. Thus we reach a new kind of complication resulting from different phenomena following each other in the course of time in the same place. The geographical setting remains the same, but the men who dwell in it have wants that are constantly growing, changing, and becoming more complex.

Denmark's ancient capital, Roskilde, was situated near the water, on the island of Zealand, at the end of a long fiord that penetrates the island from the north. Such a situation was extremely favourable to defence, but too distant and secluded to dominate the sea. In the fifteenth century King Christopher preferred Copenhagen, or Kjöbenhavn, and this city won the day in virtue of its incomparable situation near the great highway of the Sound—a position of greater peril, but also of greater power. Roskilde, with its lofty twin-towered cathedral, dating from the eleventh century, though more than once rebuilt and restored, is the dead city of the royal tombs: of its former 100,000 inhabitants fewer than 12,000 remain, while Copenhagen is a 'semi-millionaire' city.

Relations between the constant natural factor and the variable human one are continually changing, and it may even happen that in course of time the relation becomes almost exactly opposite what it was at first.

Around the Mediterranean, in all the countries that make up the Mediterranean world—Asia Minor, Greece, Italy, Provence, Spain, and the islands—the houses are scarcely ever isolated and scattered, but grouped in little towns and villages, and closely packed together so as to cover all the available area of a peninsula or an island, while on the coasts they are piled up, so to speak, round a more or less steep rock, crowned by a citadel. Sometimes the village itself is perched on the rocky height, like a land islet, which thus appears from the distance to be crenellated with houses.

The men of the Mediterranean world have banded themselves together in quite small towns well suited to defence. What happened is that the inhabitants of the cultivated areas were caught, as it were, between the nomads and robbers of the interior on the one hand—the shepherds of the dry and mountainous hinterland, with their huge migrating flocks—and, on the other, the nomads and robbers of the sea—the professional pirates. Hence arose the collective psychological tendency to choose for permanent settlement strong points or rocky peaks which would serve as useful posts alike for observation and for defence. It is in the action of this psychological element, in some cases conscious, but in others imitative, traditional, and extremely vague, that the explanation must be sought of this type of ancient Mediterranean aggregation. (See Fig. 54.)

The natural setting remained the same, but was useful in turn to opposing kinds of human

[1] Marcel Dubois, *La Crise maritime* (Paris, 1911).

phenomena, according to the impulses by which its inhabitants were swayed. If they were concerned primarily with self-defence they chose the rocky peaks for their abode. But if some other psychological factor outweighed that one, if the fear of the robber disappeared and gave place to the desire to feed as well as possible or to get rich as quickly as possible, then they came down from their mountain heights. But that is not all: another fact of human geography came into existence—the highway. This does not 'create' the social type, whatever one may say, but it does express and strengthen that psychological tendency that drives men to a better understanding and a better use of facilities for human intercourse. And whereas the ancient Mediterranean town was to remain perched near its citadel, or on its ruins, a new one was built near the railway-station, in direct contact with the highway.

The human psychological element, therefore, which at the *origin* of the geographical phenomenon is the necessary intermediary between Nature and man, might be called —to use a general phrase that was dear to Henri Bergson—'the direction of attention.' And a psychological factor is still the necessary intermediary between Nature and man in respect of the social, historical, and political consequences that follow it. Of these houses grouped in villages or towns, and of this close contact and crowding together of the dwellers in the islands and peninsulas, are born habits of town life and social life, and no doubt also a certain 'political' temperament not unrelated to the concentrated form of the πόλις.

States too are works of human art, depending on the soil and to some extent impressing their image upon it. It has been said, with equal wit and wisdom, that "between conquest and destruction there is often only the width of a good police force and a Government concerned with safeguarding future wealth."[1] These collective wills are expressed on the ground by towns and roads, crops and factories, and so forth, and they are expressed also by frontiers. Much nonsense has been talked about alleged 'natural' and 'artificial' frontiers, and even if we ignore the absurdities the truth is merely an approximation. The Rhine and the Rhône, which in certain parts of their courses have several times in the past been important imperial frontiers, are no longer so to-day. On the other hand, our frontiers often pass across mountains, zigzagging to follow the capricious line of a water-parting, whereas in other days and other parts of the world there are mountain massifs that do constitute genuine racial entities with a certain measure of independence, in conformity with truly geographical considerations. And, lastly, the sea-coast is surely a frontier only to a relative extent. The activity of the coast-dwellers always spreads over the adjoining sea areas, and it was surely the sea, and the sea alone, that gave birth to the political groupings of the Phœnicians, the Carthaginians, the Greeks, and even, though to a less extent, the Romans. Nor is it necessary, I imagine, to recall what the sea means to certain great political empires of to-day, in the Far East and the Far West.

Are there any frontiers in Nature apart from the limits rigorously set to the expansion of collective human life? Are there any true frontiers between human groups? In the facts of physical geography we find only the natural boundaries that we are looking for. What I mean is that a certain point becomes a true boundary only according to the way the adjoining regions are occupied and according to the notion formed at different times and in various historical communities of what is required of a frontier. The whole of political geography, in short, needs to be amended and started anew, and that is the task that *La Géographie de l'Histoire* [*The Geography of History*] has tried to perform.

The power and the means that man has at his disposal are limited, and in the beginning he is up against insurmountable barriers in Nature. So, too, our activity on the earth's surface finds itself stopped by restrictive conditions. Within certain limits it can vary its operations and movements, but it cannot destroy this natural setting: to modify it is often possible, but never to eliminate it.

[1] René Pinon, in *Revue hebdomadaire*, November 11, 1911, p. 178.

The way in which influential geographical conditions are translated into human facts is what human geography in all its departments must inquire into and elucidate. It must never forget that the facts of human geography find neither their complete explanation nor their single co-ordinating principle in geographical causes alone. *The psychological repercussions of geographical causes on the human being, within the bounds of his own desires, needs, or fancies*, are indeed the subtle and complex factor that should predominate in all study of human geography. This it is that enables the facts to be classified and co-ordinated, in regard both to natural forces and to man.

Many geographers, after speaking, not without reason, of the action and reaction of natural and human forces, ask themselves too strictly and in too abstract a manner up to what point the influence of natural forces is exerted on human activity and to what extent man reacts to these forces. There are some who ask in addition whether it would not be advisable to start by discriminating between the effects of the first and the second of these two influences, and then to adopt as the bases of a general scientific division these two antithetical terms: 'the action of Nature upon man' and 'the reaction or action of man upon Nature.' Hence arise the phrases 'passive or static human geography' and 'active or dynamic human geography.'

Now, what are we to think of these 'chapter headings' that some would propose to adopt? Such a general classification of the facts of anthropogeography is, in our opinion, far too artificial to be accepted or even tolerated. On the contrary, even in the most elementary facts there are discernible an action and a reaction that are inextricably intermingled.

The man who takes refuge by night in a natural cave profits by a natural circumstance, and the part he plays in relation to physical Nature is reduced to a minimum. Nevertheless it is not the cave alone that is a fact of human geography, but the cave as a place of human refuge. Even when man in no way creates or modifies the fact that he makes use of, the mere fact that he does make use of it presents a complex phenomenon in which the man, it is true, submits to what Nature suggests, but in which he also shares, if only by a kind of very obscure instinct. The river that man makes use of to journey in a canoe or to float the logs that he has to transport has a place in human geography only because it has been made a highway, so to speak, by the will of man. So the most rudimentary manifestations of our activity on the earth reveal in themselves the close solidarity that exists between that branch of human geography that is wrongly called passive and that which is equally wrongly called active or dynamic.

Man is never completely passive, or, rather, he is entirely passive only when the agents of the physical world deprive him of life. So long as he is alive he acts and reacts: he eats and drinks and lies down on some spot on the earth to sleep, and in all of these acts it is easy to recognize the signs of his own participation in geographical facts.

*"Man is not completely passive because he has the important faculty of *choice*. He has to 'take sides,' as Vidal de La Blache puts it. Japan is a country admirably suited to stock-raising, yet all that we find there is small-scale garden cultivation. The Japanese, though presented by Nature with one solution, have chosen a different one. We are not automata, controlled by an inescapable destiny, but neither are we absolutely self-governing."*[1]

Human geography is a realm of compromise: nothing is absolute or definite for the human species on the earth except those general laws and fundamental principles that determine the limits beyond which all life is excluded and proscribed. Yet men are

[1] F. Lefèvre, *Une Heure avec . . . Jean Brunhes* (Paris, 1929).

capable, if not of pushing back indefinitely those limits—altitude, latitude, depth, and so forth—at all events of stretching or modifying some of them a little. Thus the Norwegians, in quest of coal, have established a human settlement in the Spitsbergen archipelago, hitherto completely uninhabited.

On the other hand, in the restricted realm wherein man is able to live he is never completely active—*i.e.*, a creator—any more than he is completely passive. When he digs tunnels or cuts through isthmuses he is not eliminating natural facts, but merely altering them, shaping them, interpreting them. These natural facts that have been altered—mountain masses, reclaimed areas, and so forth—still remain, and so strong are they that constant human effort is needed if man's alterations are to continue in existence.

If the ancient canal from the Nile to the Red Sea were no longer kept in repair the fact of human geography would be wiped out and disappear. If the tunnels on our great railways were not inspected and looked after it would not be many years before they were destroyed. If in a big coal-mine the twofold task of renewing the air and pumping out the water were interrupted for a few hours the mine would become a tomb. If the irrigation channels of Ghadames, Balkh, or Palmyra ceased to be safeguarded by careful and constant toil the oasis would grow smaller and eventually disappear, and where once stood the resplendent city of Palmyra there would dwell only a handful of poor Bedouins turned sedentary.

Once again we are bound to assert that it is an ever-varying psychological bond that determines, temporarily and never irrevocably, the relations of co-existence between the phenomena of physical geography and the facts of material human geography, or between these latter facts and those of social, political, military, and administrative geography.

4. Human Adaptation to Geographical Conditions

Because man lives on the earth he depends on the earth. Although undoubtedly natural facts alone are far from explaining everything, yet soil, climate, hydrographic conditions, and so forth have very important effects and are responsible *in general* for the order—often much too *dis*orderly—of human phenomena. It is essential, too, for men to recognize precisely the true reality of the natural conditions that form the setting of their lives, and to know always what precise geographical facts they will have to face. With rare and skilful flexibility man's genius adapts itself to the most varied conditions: the events that do overwhelm and paralyse him are those that are abnormal, or at least unexpected.

A temperature of 25° F. is more disastrous for the Neapolitans, living in houses that cannot be heated, than one of — 5° for the Swiss, who are regularly prepared for the winter's cold and able to protect themselves against it. There are some countries, like those of Western Europe, where the freezing of canals or rivers puts an end to traffic completely during the winter, and there is a terrible spell of unemployment. But there are other countries, on the contrary, where the freezing of the rivers is so much the normal and regular thing that it is looked forward to not only without fear, but even with hope: it is when the rivers of Northern Russia, Siberia, and the Urals are frozen that human activity is resumed.

In the Spanish town of Malaga in January 1895 I remember witnessing the utter confusion caused by a slight fall of snow—barely a couple of inches—when for several hours there was no movement of any animal or vehicle, no trams, and no carriages.

In our land we have no knowledge of the terror caused by floods. Against fire, even the biggest conflagrations, we can always have recourse to water at all events, but against water itself the efforts

of man are of no avail when it comes unexpectedly—as erratic as it is deadly. When, however, the phenomenon is a periodic one it can be foreseen and to some extent guarded against. The life of Egypt has in all ages been regulated, down to the smallest details of human settlement and cultivation, not only in spite of the rise of the Nile, but in accordance with it. The Nile floods are always real floods, with all their violence and all their perils, but so closely are they bound up with the entire creative and agricultural economy of Egypt that the inhabitants not only take them into account, but depend on them.

For mankind on the earth's surface, therefore, everything is a matter of habit, of a sound understanding of physical facts, and of skilful adaptation to those facts. But the adaptation must take effect promptly and at the right moment, as well as being preceded, prepared for, and led up to by precise scientific investigation. The penalty exacted for acting contrary to physical facts is all the more cruel as man's victory over them is great and glorious.

A mere natural consequence, such as the sinking of the land of marshes that have been drained, and just *because* they have been drained, is enough to bring all enterprise to an end. For instance, in the neighbourhood of Aquileia, on the Adriatic, some marshy lagoons were reclaimed and some 4000 acres of new land put into cultivation, but later this drained land sank and was again overwhelmed by the sea.

When man succeeds in building dikes to hold back the waters of a Po or a Hoang-ho, or manages to drive the North Sea back and win the Dutch polders, the risks he runs are proportional to the fruitfulness of his efforts. An invasion of the sea or an abnormal flooding of these rivers is destructive to the very extent that the natural forces were victoriously tamed. Thus in January 1910 the Seine, which in Paris is confined by vertical embankments to a bed too narrow for it, took a disastrous revenge. In connexion with the great barrage reservoirs constructed for irrigation purposes on swift-flowing rivers, as in Spain and Algeria, I have shown elsewhere, especially in my book on irrigation, how critical was the situation created in the irrigated areas on the morrow of those torrential floods that carried away much splendid masonry.

That it is better to be content with a partial victory over natural forces than to court catastrophic defeat should be one of the golden rules of geographical adaptation.

So also in a sense it is putting a strain upon natural conditions to overdo the extended cultivation of a crop and increase its production to excess. The number of mouths and stomachs in the world that are fitted to absorb coffee or wine is limited, and neither the total number nor the individual capacity of these organs is capable of sudden alteration. It must be added, too, that to regulate the needs of consumers there intervenes as a primary factor a psychological one—taste, fashion, customs, and tradition—which is the real master.

The peasant in our part of the world to-day consumes coffee, tea, chocolate, sugar, and potatoes, all of which products were either luxuries or entirely unknown only two centuries ago, but so well has he adapted himself to these foods and drinks that he scarcely realizes how new they are. This proves how readily men can be trained to something new and how mighty can be the influence of a change in public opinion.

But there is a maximum limit to human consumption, and man's wants are also limited, and a wise and reasonable exploitation of the earth should not exceed these limits, for if it does the result is poverty. An over-abundant production of wine in Southern France or of coffee in the Brazilian state of São Paulo used to be a worse calamity than all the shortages. Monoculture was the great temptation that beset every region of the earth, because of the world consumption that was possible under the system of what has

been called 'transport civilization.' A tendency has therefore been apparent everywhere towards regulating production, and this has been carefully noted in those little worlds of unstable equilibrium, the irrigation oases.

Faced by an overproduction of coffee, which first made the fortune of São Paulo and then threatened its businesses and its credit with complete financial collapse, the Brazilian state became itself a trader in order to exercise moderation in placing the surplus produce on foreign markets, while strictly prohibiting the planting of any more coffee in its territory. To this operation the term 'valorization of coffee' was applied. Japan adopted a similar method in the case of silk. Other states, affected by similar anxieties, sought a remedy in trade combinations of a different kind, such as the agreement between Greece and the Paris association for the purchase of the former's entire crop of currants, whatever it might amount to. And finally there grew up everywhere *combines* and *cartels* of producers. We cannot study here the various ways in which these have been organized, or consider whether the part they play is beneficial or the reverse, but their ultimate result is restrictive regulation of production, and frequently a distribution of surrounding markets between the members of the combine.

The effects of this immense geographical solidarity are felt in the life of the world, and the 'engineers' of human facts, which is what the 'economists' are, need to discover and learn more and more of the laws of geographical adaptation.

Surely it is at least partly an illusion to think that by increasing his power of dominating and conquering the earth man throws off its tyranny and increases his own independence? Is it not the case, on the contrary, that a kind of contract is signed by the civilized peoples of the world, with more precise and, we might almost say, more Draconian clauses, just in proportion as their relations with the earth are made more cohesive and more fruitful?

To conquer a country is to be more dependent on it: one depends on it because one has conquered it. . . . On the day when man planted vines along the Côte d'Or he set his foot on the path of a certain solution of the problem. But undoubtedly he is bound in consequence by this latter choice, and is himself changed by the nature of his work and dependent on the natural setting that he has made for himself. (See Fig. 78.)

Is it not also an illusion to imagine that the concentration of human beings, and therefore of human forces, at one point in space must show a greater mastery over the earth? That is the illusion of number and multitude. Surely a city like Paris is more firmly riveted to the site on which it stands than the ancient Lutetia or those temporary villages of dried mud in the Nile valley that we described earlier? So strongly is Paris enslaved by the need for food and economic life in general that the slightest interruption of her normal communications would lead to catastrophe. And such masses of humanity as those of India and China render useless all the efforts that can be made to feed them if there happens to be a shortage of wheat or rice and hunger takes control.

The human individual is active and mobile with an intensity and a might that have increased more than a hundredfold during the past hundred years. But this very ease of movement on the part of individuals should not blind us to the relative but real degree of fixity with which human groups and masses are rooted in the soil. It is only under the irresistible impulsion of death or poverty or hunger that a group becomes unrooted. The dwellers in an Alpine valley, if driven from their homes by an avalanche, a landslide, a fire, or economic ruin, can, up to a certain point, leave those homes and emigrate, whereas on the morrow of a catastrophe a city like San Francisco, Tokyo, or Messina remains bound to the same site, or its immediate neighbourhood. Though each of the individuals

who live in London or Berlin is free to take the train each day and go away, it is equally certain that the entire population of these cities, if it wants to remain fed and housed, is as a body inexorably compelled to stay where it is.

It should not be thought, therefore, that as human forces grow and become more concentrated man's dependence on natural conditions has been done away with: all that has happened is that the dependence is of a different kind. And geographical facts are more and more becoming man's supreme masters. The facts that tend increasingly to influence the destinies of human groups—the tyrannical factors of human geography—are **space, distance,** and **difference of level.**

Space, which includes not only the surface that is occupied, but also that which is capable of being occupied, is a form of wealth that is undeniably the basis not only of every great city in the physical sense, but of every powerful community. Modern states fight for space. So, too, in all the great urban aggregations in the Old and the New Worlds alike the population is stifled because of insufficient space and because many of the people are deprived of the indispensable minimum—a place in the sun and on the earth. In the last analysis is not a minimum of space the significant basis and the geographical mark and guarantee of every human being's primary and imprescriptible right—the right to live?

Distance is the obstacle to be overcome, an obstacle which is measured by time. Now, time, in and for economic relations, is the supreme ruler of a civilization founded on communications, and the second standard of sovereign wealth and power. If we recall to mind, from the point of view of the distances to be covered and the results as regards human facts, the vicissitudes of the wars between Spain and the United States, between Great Britain and the Transvaal, and between Russia and Japan, we shall realize the numerical superiority in man-power that would have been needed, or that *was* needed, to make up for the inferiority arising from the thousands of miles that lay between the theatres of war and the base of operations in these different cases—for the Spanish, the British, and the Russians alike.

In the strictly economic sphere, but also in a general way, the development and speeding-up of communications have altered relations of distance, and thereby even the geographical distribution, relatively speaking, of men and products. But it would be inaccurate to claim that distance is a factor that no longer counts, or that counts much less, because we can reach a given point in space more quickly than before. On the contrary, the capital importance of this factor remains, and the part it plays is shown by the very complexity and extent of the organization of communications.

Lastly, **difference of level** means giving freedom to gravity to act on water, and as a form of economic wealth it is used as a standard of force. It is a new form of wealth, or, rather, of potential wealth, and it has hitherto operated in the opposite direction by giving real inferiority in the economic struggle to populations settled at high altitudes, though to-day it is found to offer free advantages that nothing else could equal or replace. All this results from the efforts of man himself and the importance he has given by his work to these terrestrial realities. These realities are as old as the world, but their explanation and utilization are new, even revolutionary, by reason of and in proportion to man's ingenuity and intelligence.

Space, distance, and **difference of level** become, in fact, geographical values because to satisfy his needs man enslaves and tames them. Now, this domination by man can show itself, over and over again, only by the construction of factories and fortresses, roads, canals, and railway stations, the creation and upkeep of fields and gardens,

transport animals and flocks and herds, and the exploitation of the earth's natural covering of vegetation and its mineral wealth. **Space, distance,** and **difference of level** are conditions and factors of human work and settlement, but they must never be confused with the actual forms of that work or the physical evidences of that settlement. They are means, more or less favourable or unfavourable to life, wealth, or power, but they are not the direct ends pursued by individuals, tribes, or nations. In themselves they belong to pure natural geography, and it is only if they are 'animated,' as it were, by the spirit of man and mingled with our life that they influence and take their place in the geography of man. And this simply means that they must find expression in some of the six types already described. Thus we reach, over and over again, the same important conclusion, that physical phenomena, like human ones, have right of access to human geography only to the extent that they are connected with positive surface phenomena belonging to one of the three groups of facts—**unproductive occupation of the soil, conquest of the vegetable and animal worlds,** and **destructive occupation.**

Concluding Summary of Views on the 'Essential Fact' Method. What is Geographical and what is not

The essential facts are not the whole of human geography, but everything that is included in human geography is closely and directly related to one or more of the essential facts.

Paul Vidal de La Blache has published a couple of articles of singular acuteness on "Ways of Life in Human Geography,"[1] which should be carefully studied, for they show to what extent those human complexes of traditions and needs, and those precise forms of domination of Nature and of community life that the author calls 'ways of life' are revealed, as it were, through the agency of the 'essential facts.' Certain it is that the house and the highway—constituting what I have called elsewhere the 'fundamental seed-beds of settlement'—have during the past ten years been treated more and more and better and better as objects of study to be placed in the very forefront of geography.

Since our opportunities and facilities for the conquest of the earth have been increased by the development of air transport and aerial photography it has been realized that the differing fundamental characteristics of the various regions of the earth from the point of view of human geography have been determined primarily by the infinite number of combinations of landscapes connected with houses, roads, and fields, and all forms of aggregations that result from these, up to and including

[1] *Annales de géographie*, vol. xx, 1911, pp. 193–212 and 289–304.

**Map XL*

The Two Main Types of Roof in France

By Jean Brunhes and Pierre Deffontaines

The map of roofs included in the *Géographie humaine de la France* was originally one of a series of studies defining the boundaries and distribution of roofs, and the map shown here has been modified by taking these studies into account. The changes made are as follows: the extension north-eastward of the islet of pantiles in Lorraine; the prolongation of the area of pantiles to the north of the Central Massif, so that the latter now appears as an island of high-pitched, flat-tiled roofs, whereas before it was shown as a peninsula attached to the northern area; and the addition of a small area of pantiles in Switzerland, between the end of Lake Geneva and the French frontier. Later researches show that the islet of pantiles in Lorraine extends to the south of Luxembourg and Belgium, and is in reality an important area.

Map XL

[See opposite for legend.]

the great city in the strict sense. This indisputable physiognomic and, if one may say so, humanly structural pre-eminence is shown by the air photographs. (See Figs. 1, 2, 48–51, 61–67, 75, and 78.)*

Next, therefore, to the physical features of the regions of the earth—relief and contours, watercourses and coastlines—there is nothing human that is so important, fixed, and permanent as the grouping and appearance of the streets and highways, the dwellings, villages, and towns. It is from this point of view that such a physiognomic feature as a roof appears to every observer, especially if he flies over our part of the world in an aeroplane, not only to have a regional character, but to be worthy of a place in descriptive accounts of more extensive areas. Hence there arose the idea of comparing the roofs in the south of France, gently sloping and covered with curved tiles, with the solidly built northern roofs, steeply sloping and covered with thatch, small flat tiles, slates, or shingles. So with the help of Pierre Deffontaines I prepared the first map of the roofs of France for inclusion in the *Géographie humaine de la France*. (See Map XL and Figs. 46 and 47.) If the explanation of this distribution of roofs is not yet definitely determined, that is no reason why so striking a feature of the human landscape should not be given its full value in the form of a geographical outline.

Geographers should never forget what belongs to geography and what has nothing to do with it. Still more should those who are not geographers, such as artists, archæologists, historians, economists, and so forth, give up asking geography for erroneous or at all events fanciful explanations. What is essential is to ban all such formulæ, hitherto triumphant, as these: "The art produced by the soil and the climate . . .," "The history made by soil and climate . . .," "The human temperament of a community . . .," and even "The individual genius born of the soil and the climate. . . ." Terrible blunders have been caused by such over-simplified searches for explanations as these.

"La Ferté-Milon, the trim little town on the Ourcq where Racine was born, is less than twenty miles from Château-Thierry, on the Marne, the birthplace of La Fontaine. But the chances of capricious political dominance and demarcation of boundaries put La Ferté-Milon in the province of Ile-de-France and Château-Thierry in Champagne. So, fooled by these artificial divisions, the critics, with their mania for trying to connect a man's character, his talents, and even his genius with some ill-digested kind of geography, have endeavoured to explain the easy-going Champenois La Fontaine by Champagne and the purely 'French' Racine by Ile-de-France! They could have saved their labours if for a verbal knowledge of conventional geography they had substituted an understanding of those real unities, made up of varying features shading into each other, that go to form the harmonious land of France."[1]

Let empty rhetoric be replaced by careful observation and analysis. If soil and climate have their effect on a very large number of human phenomena there is beyond all doubt some positive and tangible fact which is at the same time the result and the agent of this effect, and it is in this direction that our first search should always be made. For outside the 'essential facts' there can be no sound study of human geography. It is by them that even the imponderable and immaterial factors that make up the life of communities—that make their customs, their history, their art, and their civilization—are translated, so to speak, into a geographical form. Every people and every human settlement clothe the surface of the earth with these visible signs that reveal their presence, reflect the way they live and their power to act, allow their past to be interpreted and understood, and sometimes even enable their immediate future to be forecast.

[1] Jean Brunhes, *Géographie humaine de la France*, vol. i, p. 377.

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PLATE I. MAN'S IMPRINT ON THE SURFACE OF THE EARTH

FIG. 1. ESSENTIAL FACTS OF HUMAN OCCUPATION: HOUSES, ROADS, AND FIELDS

It will be seen that the houses, roads, bridge, and fields 'biting' into the forest are just as distinctive features of the landscape as the course of the river, the erosion of its banks, and the mantle of vegetation. View from the air of a region on the shores of the Mistassini, north of Lake St John (Quebec), colonized in the nineteenth century. (See Map VI, *p.* 57.)

[*See pp.* 37, 56, 230–232.]

Photo Royal Canadian Air Force

FIG. 2. NÎMES: URBAN LANDSCAPE, ESSENTIALLY A 'HUMAN GEOGRAPHY' LANDSCAPE

"If a rural landscape may be said to be largely the work of man, what is to be said of an urban one? The natural relief is transformed and replaced by new shapes—houses cut up into blocks by deep and narrow streets like canyons; the ground hidden by buildings, pavements, and roadways; the vegetable covering reduced to a few tree-lined avenues and wooded 'islets' in gardens. . . . There is no countryside with so elaborate a network of roads as the streets of a town. . . . In towns the very air itself is changed and vitiated, and everything is of an artificial character."—JEAN BRUNHES and PIERRE DEFFONTAINES, *La Géographie humaine de la France*, vol. ii, pp. 102–103.

[*See pp.* 37, 63, 230–232.]

Photo Cie. Aérienne Française

Fig. 3. Castle of Bellver, near Palma (Majorca)

On the upper terraces of the castle everything is planned so as to collect every drop of rainwater.

[*See p.* 40.]

Photo Jean Brunhes

Fig. 4. Mouth of Cistern in the Inner Court of Bellver

The water so carefully saved is collected in a great cistern extending beneath the central court.

[*See p.* 40.]

Photo Jean Brunhes

Fig. 5. Vine-growing on the Flanks of Mount Etna, in Sicily: a Type of 'Dry Farming'

On account of the irregularity of the rainfall a small cone of loose earth is built around each plant to absorb and retain the water when the rare but very heavy showers occur. By all these ingenious methods of cultivation and the 'harvesting' of water man succeeds in modifying climatic conditions.

[*See p.* 40.]

Photo Jean Brunhes

FIG. 6. SMALL IRRIGATION CHANNEL, OR 'BISSE,' IN VALAIS

The water coming from the glaciers is collected and conducted with great care into these *bisses* to irrigate the upper pastures.

[*See p.* 192.]

Photo Jean Brunhes

FIG. 7. CULTIVATED TERRACES IN MAJORCA

On the west coast of Majorca these terraces are carefully maintained. Such terraces, with dry stone walls, are a feature of many Mediterranean landscapes.

[*See pp.* 38, 40, 196.]

Photo Jean Brunhes

FIG. 8. MAGNIFICENT ARRAY OF TERRACES IN GREAT LEBANON (SYRIA)

On each of these terraces the inhabitants make incredible efforts to keep the earth loose. This arrangement of crops in terraces was formerly of such importance in Lebanon that, despite the decay at the present time of the shrubby crops for which the terraces were intended, this part of Syria is regarded as the original home of this kind of 'dry farming.'

[*See pp.* 38, 40.]

Photo Jean Brunhes

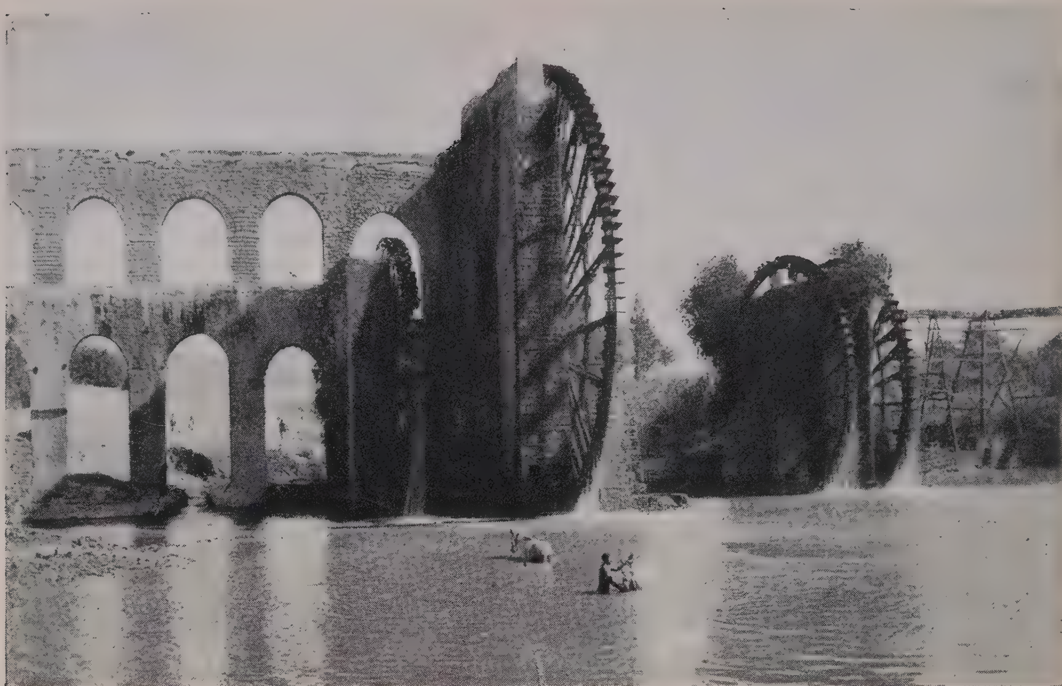

FIG. 9. WOODEN WHEELS AT HAMA (SYRIA)

These great wheels, turned by the current of the Orontes itself, raise the water and discharge it into the lofty aqueducts. The man and horse in the foreground show the unusual size of these wheels, called 'norias.'

[*See p.* 41.]

Photo Jean Brunhes

FIG. 10. THE USE OF WATER-POWER TO RAISE WATER FOR IRRIGATION

A 'tabout' with paddles in the Faiyum oasis (Egypt). The running water drives the paddles of these hollow-rimmed wheels, and the water thus raised falls into the trenches seen in the foreground.

[*See p.* 41.]

Photo Jean Brunhes

FIG. 11. BAMBOO IRRIGATION WHEELS IN NORTHERN ANNAM (INDO-CHINA)

The Muongs of Northern Annam build great wheels, 25–35 feet across, with all their parts—spokes, buckets, and outlet channels—made of bamboo. Here, too, the current is ingeniously used to raise the water.

[*See p.* 41.]

Photo Jean Brunhes

FIG. 12. EFFECTS OF PREVAILING WIND ON OLIVE-TREES IN MINORCA

So great is the force of the prevailing winds in a constant direction that the vegetation here shows its effect. The few cultivated trees are bent over in a southward direction by a wind blowing regularly from the north, as the trees in the Rhône valley are by the mistral.

[*See pp.* 43, 197.]

Photo Jean Brunhes

FIG. 13. 'ANEMO MILI,' OR WINDMILLS, IN CRETE

These mills are common in the coastal and inland plains on the island. The water is carried up by wind-power into reservoirs from which it is dispersed into gardens. In the distance can be seen the long poles of the 'pole wells.'

[*See p.* 43.]

Photo M. Jean-Brunhes Delamarre

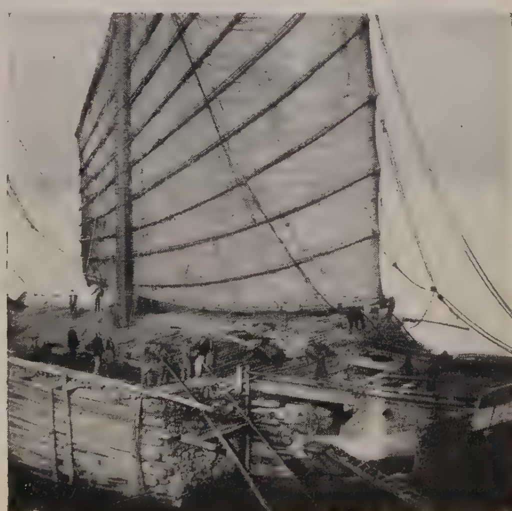

FIG. 14. CHINESE SAILING-JUNK ON THE YANGTSE

This fine junk is proceeding to Shanghai from the north with a huge cargo of timber, some of it even fastened to the sides of the vessel. The monsoon wind fills these great matting or cotton sails, which are strengthened by bamboo laths.

[*See pp.* 43, 149.]

Photo Jean Brunhes

FIG. 15. INDIAN 'CACHE' IN BRITISH COLUMBIA

This 'cache' is situated in the valley of the Skeena river. Many Indians build similar 'caches' on piles, to store the produce of their hunting and fishing after it has been smoke-dried.

[*See pp.* 49, 55.]

Photo M. Jean-Brunhes Delamarre

FIG. 16. ACROSS THE PACIFIC: A PILE-BUILT GRANARY IN LAOS (INDO-CHINA)

This characteristic type of Laos granary, with walls and roof made of a kind of interlaced webbing of crushed bamboo, is situated at Thakhek, near the banks of the Mekong.

[*See pp.* 49, 55.]

Photo Jean Brunhes

FIG. 17. TYPES OF HOUSES IN LAOS (INDO-CHINA)

On the left is a dwelling-house with a kind of open balcony with a roof above it. The building in the centre is a rice granary. These are typical of the huts built by non-Annamites. The Annamites, on the other hand, though inhabiting low-lying, moist, and very marshy or muddy areas, build their houses on the ground-level. (See Fig. 33.)

[*See p.* 49.]

Photo Jean Brunhes

FIG. 18. THIRTY MILES FROM PARIS: CAVE-DWELLINGS AT CARRIÈRES

This hamlet near Chantilly is inhabited by cave-dwellers, former quarrymen and mushroom-growers.

[*See p.* 49.]
Photo Pierre Deffontaines

FIG. 19. UNDERGROUND DWELLINGS IN CAPPADOCIA

The peaks of volcanic tuff, shaped by erosion, have been partly hollowed out and inhabited by cave-dwellers, near Urgub, west of Cæsarea (Asia Minor).

[*See p.* 49.]
Photo G. de Jerphanion

FIG. 20. GROUP OF UNDERGROUND DWELLINGS AT GUADIX (SOUTHERN SPAIN)

The little town of Guadix, with a population of some 12,000, has a suburb called Barrio de Santiago, inhabited by cave-dwellers. Several of the chimneys and entrances of these curious underground homes are shown here.

[*See p.* 49.]
Photo Jean Brunhes

FIG. 21. NEAR RAGUNDA, IN SWEDEN

A typical hay-loft, with walls of straight tree-trunks fitted together and roof of wooden slabs. Similar types are found hundreds of miles away in the forest region of Europe.

[*See p.* 49.]

Photo Jean Brunhes

FIG. 22. IN THE VAL BREGAGLIA, ITALY

Barns and hay-lofts with stone foundations and walls of unsquared trunks, well fitted together. In this valley, a southern continuation of the Upper Engadine, the roofs are covered with slabs of schist, as they often are in Grisons and Valais.

[*See p.* 49.]

Photo Jean Brunhes

FIG. 23. WOODEN HOUSE IN NORTHERN FOREST REGION OF NORTH AMERICA

Throughout the forest area that crosses Canada as far as Alaska is found the wooden house of unsquared trunks or planks. (See Fig. 40.) Note the dogs and sledge, recalling winter methods of transport.

[*See p.* 49.]

Photo Canadian Pacific Railway

FIG. 24. IN THE BRAZILIAN COASTAL FOREST, EAST OF SANTOS

The fisherman first builds a framework of slender trunks and long boughs, and then covers it with mud. The roof is made of branches and grass. This kind of building indicates a very different forest from the northern one.

[*See p.* 49.]

Photo Pierre Deffontaines

FIG. 25. A 'TRULLO' IN APULIA (ITALY)

This dry-stone building is formed of several superimposed rings. Walls and buildings of unmortared, uncut stone belong to the geographical zone of limestone slabs, or stone of different origin but also occurring in slabs.

[*See pp.* 52, 53.]

Photo Jean Brunhes

FIG. 26. HUT AT GORDES (VAUCLUSE)

Quite near Gordes there are many dry-stone huts, several of them modern, but the method is being lost as the dry-stone workers die out. Among the bushes can be seen walls that were once, no doubt, the boundaries of fields, now abandoned.

[*See pp.* 52, 53, 123.]

Photo M. Jean-Brunhes Delamarre

FIG. 27. A 'TALAYOT' IN MINORCA

The ruins of these ancient buildings are particularly plentiful in the west of the island, where there are still 'barracas'—modern replicas in miniature of these imposing monuments of the past. Note the variety of ways in which dry-stone is used for building.

[*See pp.* 52, 53, 198.]

Photo Jean Brunhes

FIG. 28. DRY-STONE HOUSE IN PORTUGAL

The Portuguese house in the Douro valley is built of huge blocks of squared granite placed one on another without mortar. The Portuguese are very skilful stone-workers, and are recognized as such throughout the world.

[*See p.* 52.]

Photo Jean Brunhes

FIG. 29. CLAY HOUSE AT MEDINET EL FAIYUM

The house is built of dried clay bricks. The arrangement of the bricks and the little opening where the pigeon is sitting show some degree of art in building, and even in ornamentation.

[*See p.* 54.]

Photo Jean Brunhes

FIG. 30. ENTRANCE TO A HOUSE IN THE FAIYUM

Above the door are the great 'sacks' for provisions, made of clay. Similar clay receptacles for provisions are often seen in Egypt, either on the ground or on the roofs.

[*See p.* 54.]

Photo Jean Brunhes

FIG. 31. HOUSES IN AN EGYPTIAN VILLAGE NEAR ASWAN

The dwellings of the Egyptian 'fellahin,' whether of clay or stone, have a poor and ephemeral character that contrasts with the huge and overwhelming edifices of ancient Egypt. Here are seen houses roofed with vaults of baked brick, but nowhere is this the only form of roof: vaults are found mixed with flat roofs and roofless walls.

[*See p.* 54.]

Photo Jean Brunhes

FIG. 32. ROOF OF MOUNTAIN CHALET IN THE BERNESE OBERLAND

Roof made of small wooden slabs carefully superimposed and joined; corners rounded so that snow-water cannot penetrate; walls of stone. (View taken above Lenk, at a height of 5500 feet.)

[*See p.* 50.]
Photo Jean Brunhes

FIG. 33. CHARACTERISTIC ROOF OF ANNAMITE PEASANT'S HOUSE

Thatched roof with the two sides separated at the top from the two ends. Note that the house is on the ground-level, unlike the houses in Laos (Fig. 17). In the background are the Annamite highlands.

[*See p.* 50.]
Photo Jean Brunhes

FIG. 34. ROOFS IN A WOODED COUNTRY: JAJCE, IN BOSNIA

The high-pitched roof of the Bosnian house is made of long strips of wood less skilfully and carefully fitted together than in other wooden roofs. (*Cf.* Figs. 21 and 32.)

[*See pp.* 50, 74.]
Photo Jean Brunhes

FIG. 35. ROOFS IN A ROCKY COUNTRY: MOSTAR, IN HERZEGOVINA

The contrast between this and the Bosnian type is striking. Here in Herzegovina the roofs, much less steeply sloping, are covered with large flakes of stone.

[*See pp.* 50, 74.]
Photo Jean Brunhes

FIG. 36. THE HOUSE AND THE FOOTPATH (NEAR QUEBEC)

Every dwelling is connected with a road, however rudimentary. Note how the lower edges of the roof are slightly turned up, a characteristic of many French Canadian houses, many of which are similar in other ways to those of Brittany, Normandy, and Poitou.

[*See p.* 55.]

Photo Canadian Pacific Railway

FIG. 37. DEVIL'S BRIDGE, SOUTH OF MALLIA (CRETE)

Every obstacle to traffic makes it necessary for some means of crossing to be found, whether bridge, tunnel, viaduct, or boat. Here the road crosses a narrow gorge by a stone bridge, stoutly built to withstand the violent rush of the torrent when it is suddenly increased by rain and the sharp Mediterranean showers.

[*See p.* 55.]

Photo M. Jean-Brunhes Delamarr

FIG. 38. BEILAN PASS, BETWEEN ALEXANDRETTA AND ALEPPO (SYRIA)

The Beilan Pass is an old historic route, marked out centuries ago by an engineered road. This view was taken from the top of the pass overlooking the winding descent on the south-west side. This road, which crosses the Amanus mountains, puts Alexandretta into touch with Aleppo in one direction and Antioch in another. Such highways are commanded and maintained by the towns, and their importance is determined by the development of towns and highways alike.

[*See p.* 55.]

Photo Jean Brunhes

Fig. 39. Bamboo Bridge between Vinh (Annam) and Thakhek (Laos)

This bridge, passable by cars, is made of a kind of vegetable webbing of crushed bamboo. (*Cf.* Figs. 16 and 17.) The bamboo roadway is supported by a few trunks, and is often carried away, or at least dangerously threatened, in time of flood.

[*See p.* 55.]
Photo Jean Brunhes

Fig. 40. Wooden Street in a Wooden Town in Alaska (Ketchikan)

Towns on the Pacific coast have been built in the forest area, and set up hurriedly to meet the needs of the trade in gold or furs, being subject, therefore, to the fluctuations of these trades. The houses are of wood, like the streets, which are laid on piles over the unlevelled soil.

[*See p.* 55.]
Photo M. Jean-Brunhes Delamarre

Fig. 41. Flagstones and Pebbles in the Streets of Cefalu (Sicily)

The street is paved with pebbles from the beach, and in the parts subject to most wear we find large flagstones. These are very commonly used for urban streets in Italy and Sicily.

[*See p.* 55.]
Photo Jean Brunhes

Fig. 42. Street of Stone Blocks at Congonha dos Campos (Brazil)

Here, in a town in the state of Minas Geraes, there is no sign of 'erosion' due to wheeled traffic. The street is essentially a steep slope meant for mule-drivers, with the gutter in the middle.

[*See p.* 55.]
Photo Pierre Deffontaines

FIG. 43. STONE STAIRWAY STREET AT MOSTAR (HERZEGOVINA)

Some features of the urban street reveal the characteristics of the geographical site on which the town was built. Such are the materials used (*cf.* Fig. 42), the lay-out of the streets, and also their 'profile.' Mostar stands on the banks of the Neretva, and several of its houses rise in tiers on the sides of the valley, so the street gets over this difficulty by means of a stairway.

[*See pp.* 55 ,88.]
Photo Jean Brunhes

FIG. 44. STAIRWAY STREET IN THE KASBAH AT ALGIERS

These stairway streets consist of wide steps, so that they are easily used, even by heavily laden beasts. Note the use of mud and short wooden posts for house-building. In Mediterranean lands, where the forests do not furnish many fine, straight trees like the forested part of Europe, wood is used rarely and sparingly.

[*See pp.* 53, 55, 88, 95.]
Photo Pierre Deffontaines

FIG. 45. OLD BUILT-UP BRIDGE AT STRUGA, ON THE DRIN (HERZEGOVINA)

Bridges and houses are so closely connected that the latter have often been built on the former. This was common in many medieval towns, notably Paris, and can still be seen at Florence, Kreuznach, Brusa, and here at Struga.

[*See p.* 79.]
Photo Jean Brunhes

Fig. 46. Houses facing independently of the Street

Serriers, a small village near Saint-Flour (Department of Cantal). At the entrance to the village the road becomes a street and gets 'strangled' by houses, which pay no heed to it: their windows face the sun. Notice in this village of the Upper Auvergne, with its inhospitable climate, the low-pitched roofs with their pantiles of the so-called 'Mediterranean' type. (See Map XL, p. 231.)

[*See pp.* 52, 63, 232.]
Photo Jean Brunhes

Fig. 47. Houses turning their Backs on the Street

Here the road, on reaching a little village on the Causse de Gramat (France), expands into a vague kind of crossroad before narrowing into a street. All the houses turn their backs indiscriminately on street and crossroads alike. They are built of stone, like those in Fig. 46, but the village is in the great 'island' of high-pitched, flat-tiled roofs in the Central Massif (see Map XL)—a type of roof like those of Northern France, though this village lies south-west of the preceding one. The steep roofs and huge chimneys give the village a general appearance entirely unlike that of Serriers.

[*See pp.* 52, 63, 232.]
Photo Jean Brunhes

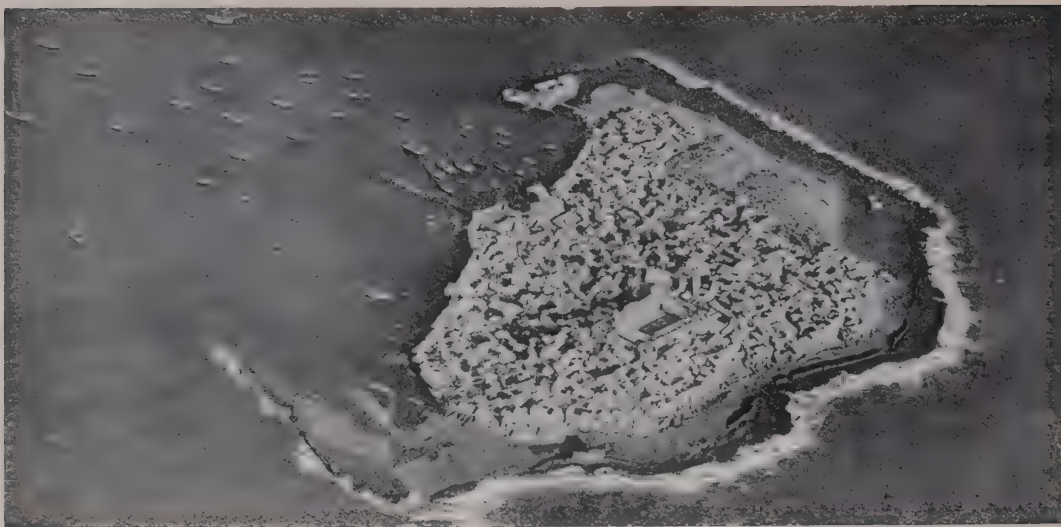

FIG. 48. MEDITERRANEAN ISLAND AND TOWN: ROUAD, NORTH OF TRIPOLI (SYRIA)

A typical Mediterranean island, completely covered with houses right down to the line reached by the waves during great storms. The island is over-populated. Note the numerous fishing-boats and coasting-vessels in the harbour.

[*See pp.* 66, 230–232.]

Photo General Denain

FIG. 49. MEDITERRANEAN PENINSULA AND TOWN: TYRE

This ancient maritime site of the Phœnician city of Tyre, or Sur (which may have given its name to Syria), is to-day fallen into decay. From this air photograph it is possible to trace its history: the ancient beach-harbour of the Phœnicians lay to the south—*i.e.*, on the left of the picture—along the gently sloping beaches now covered with sand, while the later harbour, in deeper water, is on the right. Local conditions were not favourable to human settlement, but the part played by the town, historically and economically, gave value to the geographical site.

[*See pp.* 66, 223, 230–232.]

Photo General Denain

FIG. 50. COASTAL COLONIZATION: GASPÉ (QUEBEC)

The earliest human settlements were on the coast, whence the penetration of the interior began with the conquest of the forest, and the belt of clearing and colonization is a mile deep. But the essential parts of the life of the place—road, church, and economic activity—are concentrated on the coast.

[*See pp.* 66, 230–232.]

Photo Cie Aérienne Franco-Canadienne

FIG. 51. RIVER JUNCTION AND BRIDGE TOWN: MONTEREAU

An urban aggregation closely connected with running water, at the junction of the Seine (on the right) and the Yonne. A 'transition' town where the Seine enters the tablelands of Ile-de-France, and a 'transit' town, commanding a transverse highway that has had to cross the water obstacle first by fords and then by bridges, human settlement having been determined by the vulnerability of these crossings. A town of commerce and industry, with many industrial buildings extending beyond it along both banks of the Seine. A river-port for the boats of the Seine and Yonne and the canals of Central France. Such are the many and complex functions of a single town.

[*See pp.* 77, 230–232.]

Photo A. Michaud

FIGS. 52, 53. TWO SISTER TOWNS ON VERY DIFFERENT GEOLOGICAL SITES:
LE PUY-EN-VELAY (FRANCE) AND SION (SWITZERLAND)

Hills have always been favourite sites for castles and churches, around which houses have come to be grouped. Le Puy and Sion, both minor capitals, have grown up near peaks used for defence or for pilgrimage, one on the flanks and at the foot of a double volcanic height and the other on the flanks and at the foot of a similar double peak of lustrous schist.

[*See p.* 67.] *Photos Jean Brunhes* [*See p.* 67.]

FIGS. 54, 55. TWO SMALL HILL TOWNS IN VERY DIFFERENT REGIONS:
CAGNES (ALPES-MARITIMES) AND JAJCE (BOSNIA)

Hills were favourite sites for human settlement in days when men were looking mainly for positions suitable for defence and for domination over plains and valleys. The common characteristic of these two small towns is that each grew up on a hill or its slopes. But their resemblance ends there, for in the matter of houses, surrounding countryside, and their functions to-day they are profoundly different. Thus it would be very dangerous to class all 'hill towns' in a single category, without taking account of all the other factors that may differentiate them from each other.

[*See pp.* 58, 223.] *Photos Jean Brunhes* [*See pp.* 58, 74.]

FIG. 56. SMALL VILLAGE NEAR BETHLEHEM (PALESTINE)

On the stony slopes of the limestone tableland of Judea the little stone cubes of these neat and well-built houses rise in tiers above the small terraced fields. This is one of the villages seen from Bethlehem on the flank of a near-by hill, but it is similar to many others, such as Beit Safâfa, Beit Sur, etc., and, nearer to Jerusalem, Siloam and el-Azirîyeh (Bethany).

[*See pp.* 52, 58.]

Photo Jean Brunhes

FIG. 57. TOWN, OR 'AOUL,' OF KUBATCHI, IN DAGESTAN (RUSSIA)

A stone village of flat-topped houses built one above another and clinging to the steep sides of the mountain. The whole place is planned for defence. Kubatchi is on the northern slope of the Eastern Caucasus.

[*See p.* 58.]

Photo Jean Brunhes

Fig. 64. Around Le Mans, in Western France: Scattered Houses and 'Woodland' Landscape

The roads are lonely and not flanked by houses, even at the junctions. Human settlements appear as little white masses connected, in the absence of highroads, by small by-roads. Fields and pastures are separated by hedges of trees. There are trees everywhere, giving this *bocage*, or woodland country, its green appearance. A land of enclosures, indicating individual ownership not subject to the servitude of common land. (*Cf.* Map XXVI, *p.* 105.) Many of the estates in French Canada, on the banks of the St Lawrence and its tributaries, are enclosed by hedges resembling those of Perche and Western France, from which the first ten thousand colonists came, a significant and persistent mark of human geography.

[*See pp.* 38, 58, 71, 104, 230-232.]

Photo Institut National de Géographie

Fig. 65. In the 'Garigue' of Hérault, where Part of the Moorland has been conquered by the Walls and Olive-groves of the Mediterranean Tree-growers

A Mediterranean landscape near Nîmes. Tree-growing has been gradually undertaken at the expense of that low undergrowth of shrubs and bushy plants that forms the natural vegetation of the *garigue*, still shown on the photograph by a couple of black patches. The white lines forming a chessboard pattern are wide dry-stone walls surrounding the small fields where the trees—especially olive-trees—are planted.

[*See pp.* 38, 58, 71, 104, 230–232.]

Photo Institut National de Géographie

Fig. 66. Village of La Chapelle-Monthodon, near Château-Thierry (Aisne)

The houses of this village cling to the highways and road junctions. They are in groups, but remain for the most part independent of each other. (*Cf.* Lorraine village, Map XXVI, *p.* 105.) The landscape bears the mark of profound and very ancient humanization. The surface of the fields is level and uniform. In old countries such as ours, that have been cleared so long, there is little realization of what fields were like after the trees had been felled and their roots removed, as in lands newly colonized. Years of tillage are necessary to give them the appearance that seems so natural to us. The properties include a number of plots, many of which are long strips.

[*See pp.* 38, 58, 71, 104, 230–232.]

Photo Institut National de Géographie

Fig. 67. Village of Ibos, near Tarbes, with Houses close together and closely connected with the Roads

The houses are packed closely together, seeming to jostle one another in order to touch the main highways or to line the streets and by-roads. Though they are congregated in the village, along with their gardens and trees, not one can be seen in the surrounding countryside. The agricultural land is, as a rule, much divided, and each field is itself divided into numerous plots.

[*See pp.* 38, 58, 71, 104, 230–232.]

Photo Institut National de Géographie

FIG. 68. AN IMPORTANT TOWN THAT FROM RELIGIOUS CAUSES RETAINS ITS URBAN CHARACTER AT A HEIGHT OF 11,500 FEET: LHASA (TIBET)

A religious capital and the resort of thousands of Buddhist pilgrims. Its floating population is estimated at 15,000. The approaches to it are very difficult, and foreigners are not allowed access to the town. Its importance is maintained by its religious (and political) rôle.

[See pp. 75, 58.]

Photo Alexandra David-Neel

FIG. 69. A TOWN OF ECONOMIC ORIGIN: OURO PRETO (BRAZIL), OVER 3000 FEET UP MINERS' QUARTER

This was once the gold capital, but is now in decay. Its rise and fall were bound up with the mining industry. Ouro Preto once had 60,000 inhabitants, but now has scarcely more than 20,000, and is partly in ruins, but it may acquire new importance from iron and manganese.

[See pp. 75, 158.]

Photo Pierre Deffontaines

FIG. 70. A RECENT CONQUEST OF THE SOIL: NEW SETTLEMENT IN THE ISLAND OF HAITI

Some parts of this island have been recently put into cultivation, and fields and vineyards are gradually gaining on the tropical forest. New houses are seen here in a situation that is still wild in aspect, though it is beginning to be humanized. The conquest of the soil, however, is not taking place in so 'controlled' a way as in Canada, for instance, where the plots mark out a rectangular chessboard pattern on the ground. (See Fig. 50.) Here the fields extend without much regularity just where exploitation happens to spread.

[See p. 38.]

Photo Auguste Viatte

FIG. 71. FENCE AT CHÂTEAU-D'ŒX (SWITZERLAND)

This attractive kind of fence is very common in the Alpine parts of Switzerland and Austria. Fences prevent straying and encroachment, while the simplest kinds of tracks, like footpaths, have other kinds of obstacles, such as small gates, or sometimes even mere notice-boards.

[*See pp.* 88, 123.]
Photo Jean Brunhes

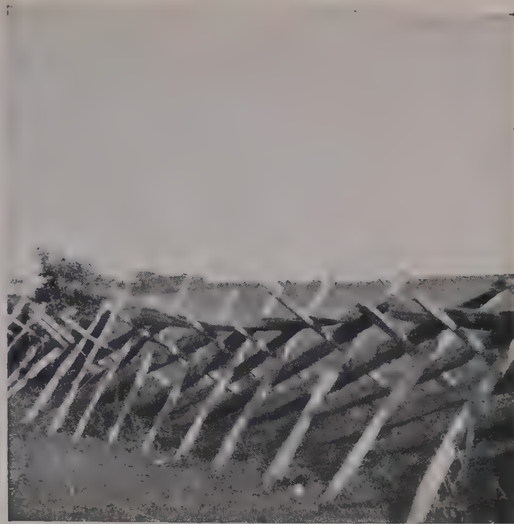

FIG. 72. CANADIAN FENCE (QUEBEC)

This natural geographical fence resembles the Swiss one, and is similarly connected by its nature with the geographical character of the forest regions. It uses up a great deal of wood, and endeavours are being made, especially in some parts of the Alps, to limit its further use, and even to replace it.

[*See pp.* 88, 123.]
Photo M. Jean-Brunhes Delamarre

FIG. 73. GARDEN WALL IN DAMASCUS

In the splendid oasis of Damascus the wood of fruit-trees is too valuable to be made into fences, but the broken stones of the alluvial fans and the terraces of the seven-branched Barada river provide the materials needed to make a crude kind of concrete from which these great slabs are made, and with them are built the garden walls.

[*See pp.* 88, 123.]
Photo Jean Brunhes

FIG. 74. TYPE OF FENCE VERY COMMON IN THE BALKANS

This kind of plaited fence is met with in all the moist and wooded parts of the Balkans, in Rumania, in the Carpathians, and as far as Central Europe and the U.S.S.R. It does not merely indicate the boundary of a property, for, as its appearance shows, it is meant also to protect the crops.

[*See pp.* 88, 123.]
Photo Jean Brunhes

FIG. 75. AIGUES-MORTES FROM THE AIR

This town, with its rectangular chessboard pattern, dates from the thirteenth century, having been built by St Louis. What is exceptionally interesting about it, as also about Carcassonne, is that within the walls and towers there still live hundreds, or even thousands, of inhabitants. The walls and towers are museum pieces, but in the midst of these masses of stone, which to-day are meaningless, life still remains, though on a reduced scale. Urban movement here is held up or controlled everywhere by the ramparts.

[*See pp.* 63, 89, 230–232.]

Photo Cie Aérienne Française

FIG. 76. PART OF THE ANCIENT RAMPARTS OF GÖTTINGEN (GERMANY) TURNED INTO A PROMENADE

Here what was a means of urban defence and an obstacle to movement has become a favourable means of communication. The promenade remains on a higher level than the streets within, but it slopes down to meet the main highways leading out of the city.

[*See p.* 89.]

Photo Jean Brunhes

FIG. 77. HIGH SQUARE TOWERS IN A SMALL TUSCAN TOWN: SAN GIMIGNANO

These lofty fortress towers recall the bitter struggles between communities and families. There were seventy-six of them in the Middle Ages, but only thirteen now remain. The long history of San Gimignano, like that of so many other towns, is revealed and summed up, as it were, in its appearance.

[*See p.* 89.]

Photo Jean Brunhes

FIG. 78. VILLAGE OF BOURGOGNE (MARNE), IN 'BARREN' CHAMPAGNE

Photograph taken during the 1914–18 War. The soil is chalk, and the smallest beaten tracks appear from above as white lines. The structure of the village has been determined by the roads and streets. Even the smallest community, especially in periods of intense human activity, becomes wrapped in a network of roads, symbolizing the almost indissoluble union between houses and highways. Note that the less perfect the means of communication the less fixed are they: those that are most easily displaced are doubled or trebled, becoming single again at the more or less compulsory crossing-places. Thus we get a kind of representation in miniature of world communications—an ordered system reflecting periods of social organization and stability, and a disorderly one that reveals an absence of organization, great insecurity, or serious disturbances.

[*See pp.* 55, 228, 230–232.]

Photo Marcel Chrétien

FIG. 79. TRAFFIC JUNCTION RESEMBLING A MUSCLE WITH CLOSE-PACKED FIBRES: THE MARSHALLING-YARD OF METZ-SABLON

Between the Moselle and the Seille these two streams have spread deposits of sand that have given the name *Sablon* to this area south of Metz. The railways going south-east to Sarrebrück and south-west to Nancy were built before the dismantling of the fortifications south of the town (1902–3), and advantage was taken of the sparsity of houses (which still marks the whole of this area) to construct huge buildings—a seminary, gasworks, and barracks—and in particular this close network of railway-lines resembling a muscle, that forms the vast marshalling-yard of Metz-Sablon. The picture illustrates very clearly the geography of communications.

[*See p.* 94.]

Photo Institut National de Géographie

FIG. 80. A RAILWAY ACROSS THE ROCKY MOUNTAINS

In this mountain landscape, dominated by a chain of serrated peaks, along with such surface features as the sharp ridges and ravines, the *roches moutonnées* and the glacial striæ, there can be seen also a winding track: it is a man-made thing—a railway. Its presence there recalls the many engineering feats that have enabled this iron road to reach these inhospitable lands and establish regular communications between regions separated by real obstacles. Nor is it simply a means of transport and communications, for, like other transcontinental lines in North America, it is also the expression of a political domination imposed on both sides of the Rockies by the bold process of joining the Atlantic and Pacific slopes by railways.

[*See pp.* 77, 94.]

Photo Canadian Pacific Railway

FIG. 81. CARAVAN ON A ROAD IN SYRIA

The road is from Beirut to Damascus, built by a French company and much frequented before the opening of the railway. Motor traffic has given it a new lease of life. It has been used in all ages by many transport caravans and convoys of various kinds, which show the economic rôle of the highway and its evolution.

[*See p.* 94.]

Photo Jean Brunhes

FIG. 82. OLD AND NEW ROADS IN CENTRAL CRETE

Road systems change, and we see here the old paved highway, suitable for asses and mules. Paved roads, called Turkish roads, are one of the marks of the ancient rule of the Turks over the island. But modern traffic has its own requirements, and here the windings of the new highway cut across the ancient one.

[*See pp.* 56, 94.]

Photo M. Jean-Brunhes Delamarre

FIG. 83. THE HUMAN BACK USED FOR TRANSPORT: A STREET PORTER AT MUDANIA (TURKEY)

Among almost all primitive and half-civilized peoples in Africa the porters carry their loads—even the heaviest ones—on their heads. As a rule the weight does not exceed 65 lb., but civilized races carry much heavier loads.

[*See pp.* 95, 201.]

Photo Jean Brunhes

FIG. 84. AMONG THE INDIANS OF WESTERN CANADA (BANFF, ALBERTA)

The Indians use this method of transport, which is lighter, more manageable, and less burdensome than a wheeled vehicle. It consists of two long poles attached to the horse's flanks and joined by a cross-piece that carries the load.

[*See pp.* 95, 201.]

Photo Canadian Pacific Railway

FIG. 85. CHINESE TWO-WHEELED CARTS

Very primitive carts with two solid wheels. The photograph was taken at one of the Chinese stations on the Yunnan railway—Pi-che-Tchai, the junction of the branch line from Mong-tse, where the tin ore arrives from the very important mines of Ko-kieou. The trucks in the picture are loaded with tin ore.

[*See pp.* 95, 133, 201.]

Photo Jean Brunhes

FIG. 86. CHINESE WHEELBARROW IN THE STREETS OF SHANGHAI

This 'town' barrow, on which one man can carry as much as five or six hundredweight, is derived from the 'country' barrow whose single wheel can pass easily over the little ridges between the rice-fields. The Chinese barrow reached Tonkin and Northern Annam long ago, but is not met with in Southern Annam or Cochin-China.

[*See pp.* 95, 201.]

Photo Jean Brunhes

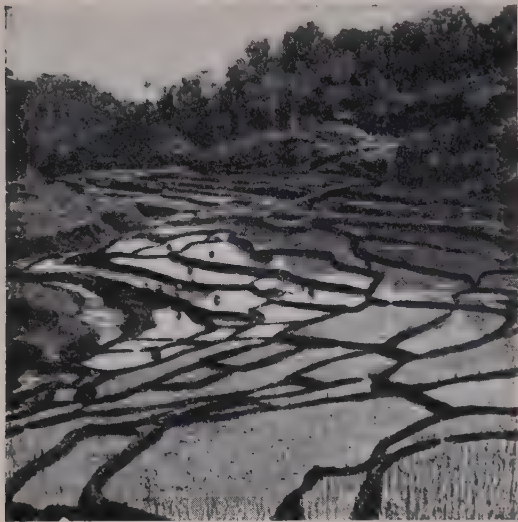

FIG. 87. TERRACED RICE-FIELDS IN JAVA

A great deal of human labour is required for making rice-fields, supervising and maintaining them continuously, growing the rice, and all that this involves. The regions of large rice production are regions where water is abundant and population dense.

[*See p.* 114.]

Photo A. and H. Reymond

FIG. 88. OLIVE-PICKING NEAR ANTIOCH

Olive-trees need to be kept fairly moist at the foot, and for this purpose many little dry-stone terraces have been constructed, though to-day they are very often neglected or abandoned. In Syria the branches are shaken or beaten when the olives are ripe, and the picking is done on the ground.

[*See p.* 117.]

Photo Jean Brunhes

FIG. 89. A BURGUNDIAN VINEYARD: CORTON

Here the stone houses are all in the village, giving it the appearance of a small town. All round this 'island' of houses and trees the splendid vineyards, with their regular and serried ranks of vines, stretch over the open slopes and right up to the edge of the woods. It is a highly specialized crop, calling for much skilful and experienced labour.

[*See pp.* 38, 52, 118.]

Photo A. Michaud

PLATE XXXI. PHYSIOGNOMIC FEATURES OF VARIOUS CROPS

FIG. 90. DRYING SHEAVES OF RYE NEAR ÅRE, IN SWEDEN

The sheaves of rye are arranged on posts with the ears so placed as to get the maximum benefit, in this latitude, from the precious sunlight.

[*See p.* 123.]

Photo Jean Brunhes

FIG. 91. DRYING HAY NEAR LJUBLJANA, IN SLOVENIA

In this moist and mountainous country the hay to be dried is placed on these great drying-racks, called *kozolec̀*.

[*See p.* 123.]

Photo Pierre Deffontaines

FIG. 92. LEMON-GROWING ON THE SHORES OF LAKE GARDA

Lemon-trees flourish in the open along the whole of the Lake Garda *riviera*, but they need to be protected in winter by open sheds. That is the reason for these whitewashed brick pillars that make such a curious feature of the landscape.

[*See p.* 123.]

Photo Louis Laniepce

FIG. 93. CANADIAN GRAIN ELEVATOR NEAR WINNIPEG

A characteristic feature of the great wheat-growing lands of North America, to be seen at the ports, on the sea-coast and the shores of the Great Lakes, and along the railways. The grain is drawn in by air suction, stored in the elevator, and then shot into railway-trucks or ships.

[*See pp.* 109, 123.]

Photo M. Jean-Brunhes Delamarre

FIG. 94. HERDS OF CATTLE IN CASTILE (SPAIN)

Across the vast tablelands of Castile, arid and bare, the herds of cows and oxen are journeying to their summer pasturage. Stock-raising and transhumance have long been established in Spain, though the latter is now diminishing.

[See pp. 38, 134.]
Photo Jean Brunhes

FIG. 95. SHEEP-REARING IN AUSTRALIA

Australia is new to stock-raising, and it has made marvellous progress in a few years. Vast regions hitherto unutilized are now given up to sheep in particular: imagine the area of grass grazed every day by a flock of 110 million sheep! Human initiative has bestowed on Australia a pastoral economy supplemented by a whole range of industrial and commercial activities that have given her access to all the great world markets.

[See pp. 38, 131.]
Photo Canadian Pacific Railway

FIG. 96. SLATE-QUARRIES AT TRÉLAZÉ, NEAR ANGERS

Man's exploitation of minerals is marked by great holes in the earth—the mines they dig, the oil-wells they bore, and the quarries they work. Here are seen the gaping holes made by the extraction of slate. Man takes wealth from the earth without replacing it: that is what we have called 'destructive economy.' This photograph illustrates the point particularly clearly.

[*See pp.* 38, 147.]
Photo Marcel Chrétien

FIG. 97. EXTRACTING IRON ORE AT KIRUNAVAARA, IN SWEDISH LAPLAND

The very rich phosphoric iron ore of the Kiruna district occurs in large homogeneous masses of magnetite that can be worked above ground, and *are* worked by the most improved mechanical processes. Here a mechanical excavator is seen at work.

[*See pp.* 38, 147, 160.]
Photo Jean Brunhes

FIG. 98. DRYING AND TURNING COD ON THE BEACH AT SAINT-PIERRE AND MIQUELON

Fishing is a form of destructive economy, taking wealth from the sea and putting nothing back. As the islands of Saint-Pierre and Miquelon are near the famous Newfoundland banks there are thousands of cod caught there and dried on the beaches or in drying-grounds.

[*See pp.* 39, 149.]
Photo E. Aubert de la Rüe

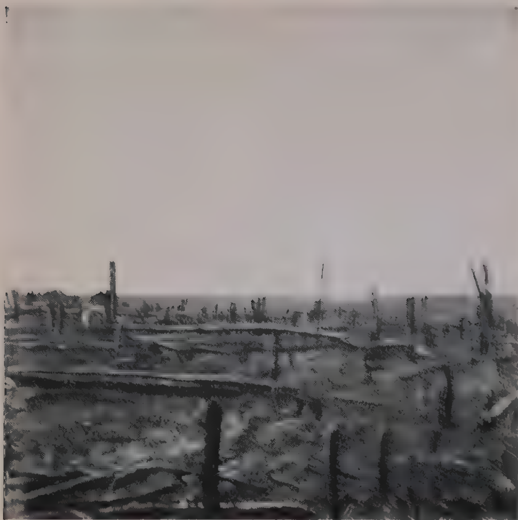

FIG. 99. DESTRUCTION OF THE EQUATORIAL FOREST IN THE MALAY ARCHIPELAGO

First the great trees of the primitive forest are cut down, and the rest is then set on fire to prepare the ground for planting rubber. In Indo-China this burn-beating of the forest by the natives is called the *ray*.

[*See pp.* 39, 148.]

Photo Jean Brunhes.

FIG. 100. FOREST DESTRUCTION IN NORTHERN PARANÁ (BRAZIL)

In South America the same method is used for destroying the forest and making the ground ready for crops. Here we see the beginning of a great forest clearance, with a half-burnt tree in the foreground.

[*See pp.* 39, 148.]

Photo Pierre Deffontaines.

FIG. 101. FOREST DESTRUCTION ON VANCOUVER ISLAND (CANADA)

Here is yet another view of forest destruction by civilized peoples. The forests of Canada and the United States have been exploited to excess for the manufacture of paper, and it is only of quite recent years that steps have been taken to control and restrict the exploitation so as to protect, economize, and even re-create the forests. A single issue of a great New York newspaper alone means the destruction of a larger forest than the one shown here. In this case human settlement will follow the destruction of the forest.

[*See pp.* 39, 148.]

Photo Canadian Pacific Railway.

FIG. 102. LOG JAM NEAR SAGUENAY, QUEBEC

All this timber was cut in winter and floated down the river from the forests upstream when the thaw brought the floods. Some obstacle in the stream has caused a jam. This harvest of logs means that a forest has been destroyed, but it means also a promise of useful industrial products—cellulose, paper, rayon, and so forth.

[*See p.* 149.]

Photo M. Jean-Brunhes Delamarre

FIG. 103. TIMBER RAFT ON THE INLAND SEA OF JAPAN

Raft of building-wood at the outlet of the Inland Sea, towed by a tug and followed by several other rafts. (*Cf.* Fig. 14: so great has been the destruction of forests in China for hundreds of years that all parts of this vast and overpopulated country are obliged to import timber.)

[*See p.* 149.]

Photo Jean Brunhes

FIG. 104. FIELD OF RYE IN NORTHERN PARANÃ (BRAZIL)

Grain has been scattered among the debris of the ancient forest (see Fig. 100), and this is the crop that has come up. The destruction of the forest has enabled crops to be grown that contribute to the progress of settlement in these pioneer regions. (*Cf.* Fig. 60.) In the background is the virgin forest that encircles the rye-field.

[*See p.* 148.]

Photo Pierre Deffontaines

FIG. 105. RUBBER PLANTATION AT LOC-NINH (COCHIN-CHINA)

Rubber is no longer collected in the old way, with no regard for the tree. Here is shown one of the finest red-earth plantations in Cochin-China, where the trees, planted by man, are methodically tapped and the precious latex is collected in little cups.

[*See p.* 122.]

Photo Jean Brunhes

FIG. 106. VILLAGE NEAR ALEPPO

This village, consisting entirely of conical white houses, like those in the next picture, looks from a distance like a collection of tents. But the idea that their shape is derived from that of tents must be abandoned. In fact, the tents of the Bedouin nomads are not conical, for they are not supported by a single pole in the centre, like those of the North American Indians: they are held up by posts in the middle and at the corners, so that they appear flattened and spread out round a slightly raised point in the middle.

[*See p.* 137.]

Photo Jean Brunhes

FIG. 107. CONICAL EARTHEN HOUSES IN ANOTHER VILLAGE NEAR ALEPPO

These conical houses are built of bricks of baked earth covered with a coating of lime to protect them. The vault is made by placing irregular rings of bricks one on another, their size gradually decreasing from the bottom to the top. The figures in the photograph show by comparison the size and height of these buildings.

[*See p.* 137.]

Photo Jean Brunhes

FIG. 108. GENERAL VIEW OF A VILLAGE IN THE VAL D'ANNIVIERS: AYER (VALAIS, SWITZERLAND)

This village is built on the most exposed slope of the valley—the one that enjoys most warmth and light every day. It has many roofs for a very small population, for there are numerous barns. The buildings, made of wood, are grouped chiefly on the sides of the principal road to the bottom of the valley and a side-road that leaves the main road on the left of the picture and goes upward towards the right. The fields are on the slopes facing south-west.

[*See pp.* 49, 187.]

Photo Jean Brunhes

FIG. 109. IN THE CONCHES VALLEY

The wooden houses, sometimes built on a stone base, are jumbled together in this village in a disorderly fashion, often turning their backs on the road, because the important thing is to face south-east. The pitch of the roofs is very slight. (For the difference between the forms of nomadism in these two valleys see the pages given under the pictures.)

[*See pp.* 49, 64, 142.]

Photo Pierre Deffontaines

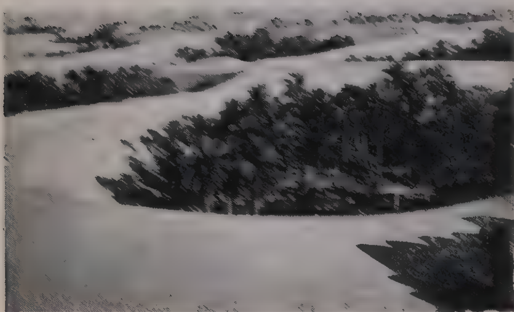

FIG. 110. GENERAL VIEW OF THE GARDENS OF EL OUED

Only the lofty heads of the palms can be seen, rising above the great holes dug in the sand of the desert. All the little black spots on the horizon are scattered holes like those in the foreground.

[See p. 178.]

Photo Raymond Delamarre

FIG. 111. HOW THE SAND THAT THREATENS THE PALM-GROVES IS REMOVED

The great hollows where the palms are grown have to be kept open, and the invading sand must be continually cleared away. The work goes on day and night, especially during sand-storms, the sand being carried up on men's backs. It is organized and controlled by a supervisor (seen in the foreground).

[See p. 178.]

Photo Jean Thomas

FIG. 112. EL OUED, SEEN FROM THE MINARET OF THE MOSQUE

Here can be seen the rows of domes that cover the rooms of each house, each dome from five feet to six and a half feet in diameter. There are arcades in the central square and in the courtyards. The view in the distance is typical of the region of shifting sandhills that surrounds the Souf oases.

[See p. 179.]

Photo Raymond Delamarre

FIG. 113. HOW WATER FOR CULTIVATION IS OBTAINED IN THE MZAB

At the top of the path can be seen the uprights above the well and the water pouring from the bucket. When the donkey walks down the path the full bucket is drawn up, the depth of the well being equal to the length of the rope. Then man and donkey retrace their steps and start over again.

[*See p.* 181.]

Photo Jean Brunhes

FIG. 114. GENERAL VIEW OF A MZAB TOWN: MELIKA

There is a striking resemblance in general outline between the seven towns of the Mzab. They stand up on rising ground with their houses grouped round the tall, pointed minaret of the mosque. Here a few palm-trees can be seen, and some nomads' tents in the foreground.

[*See p.* 182.]

Photo Jean Brunhes

FIG. 115. GHARDAÏA, SEEN FROM THE MINARET OF THE MOSQUE

Here we see the flat roofs and the houses grouped round the height crowned by the mosque. In the middle and on the left are inner courtyards flanked by arcades. In the distance is a typical view of the Chebka, whose harsh and desolate wastes encircle the splendid oases of the Mzab.

[*See p.* 182.]

Photo Raymond Delamarre

FIG. 116. SOCIAL FACTS IN TERMS OF HUMAN GEOGRAPHY: TEAMS OF MOSLEM LABOURERS IN ALGERIA

Vine-growing at Maison-Carrée on the vast estate so splendidly cultivated by the White Fathers, founded by Cardinal Lavigerie. Two teams are at work in supervised and disciplined ranks. Cultivation is highly organized, and the conquest of the soil is controlled and rational.

[*See p.* 206.]

Photo Jean Brunhes

FIG. 117. FAMILY GROUPS AT WORK IN A SERB COUNTRY

In Bosnia, near Sarajevo, the traditional collective labour of the ancient *zadrugas* still persists—a less organized system of greater freedom, in which a large majority of the women and children take part. The methods of work and cultivation are based on tradition.

[*See p.* 206.]

Photo Jean Brunhes

GENERAL INDEX

INDEX OF PERSONAL AND PLACE NAMES

(*Personal names are printed in italics. The roman numerals refer to the section of half-tone plates to be found between pages* 240 *and* 241.)